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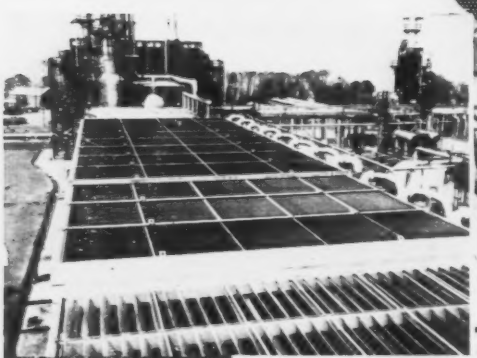

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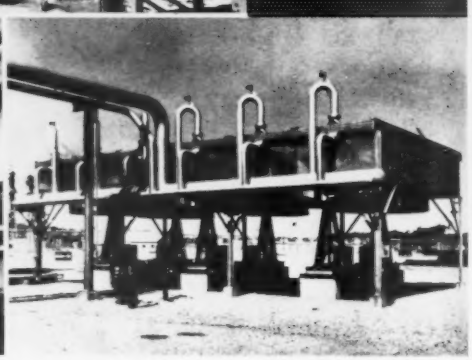

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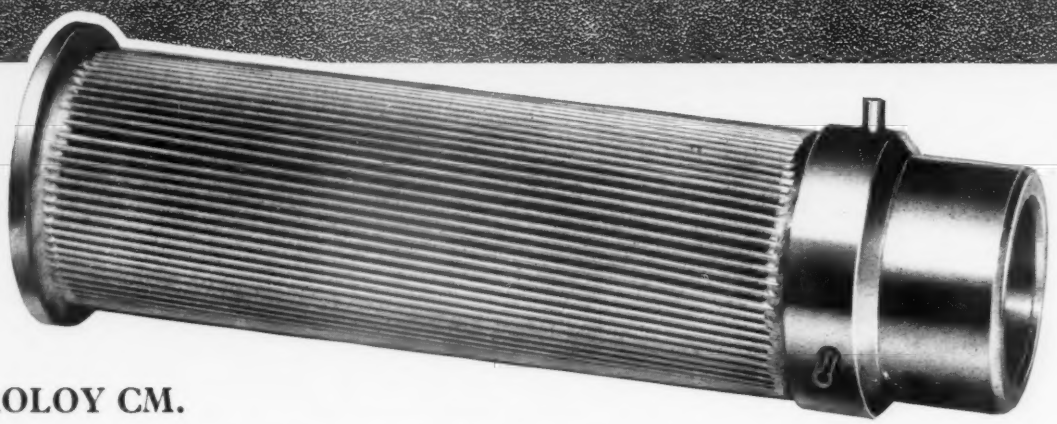

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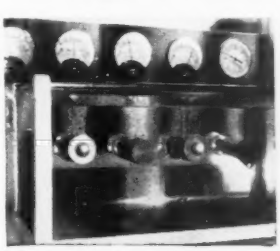

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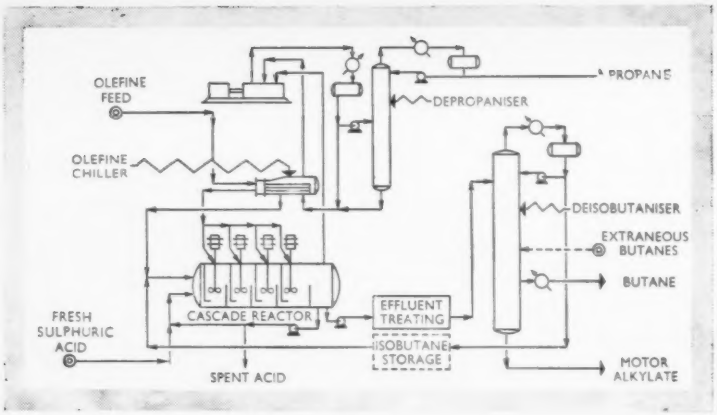

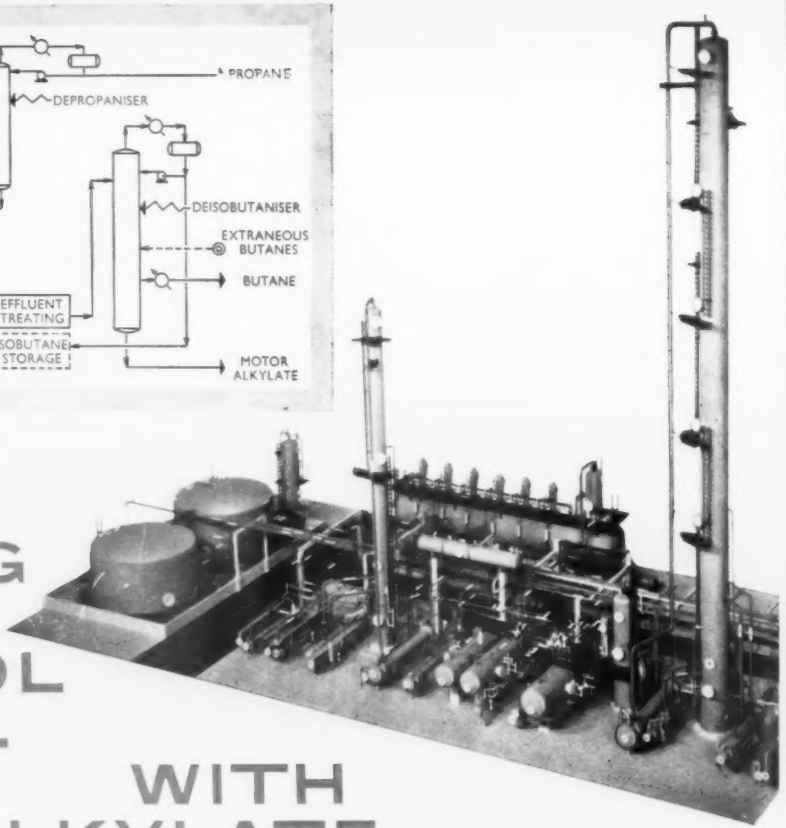

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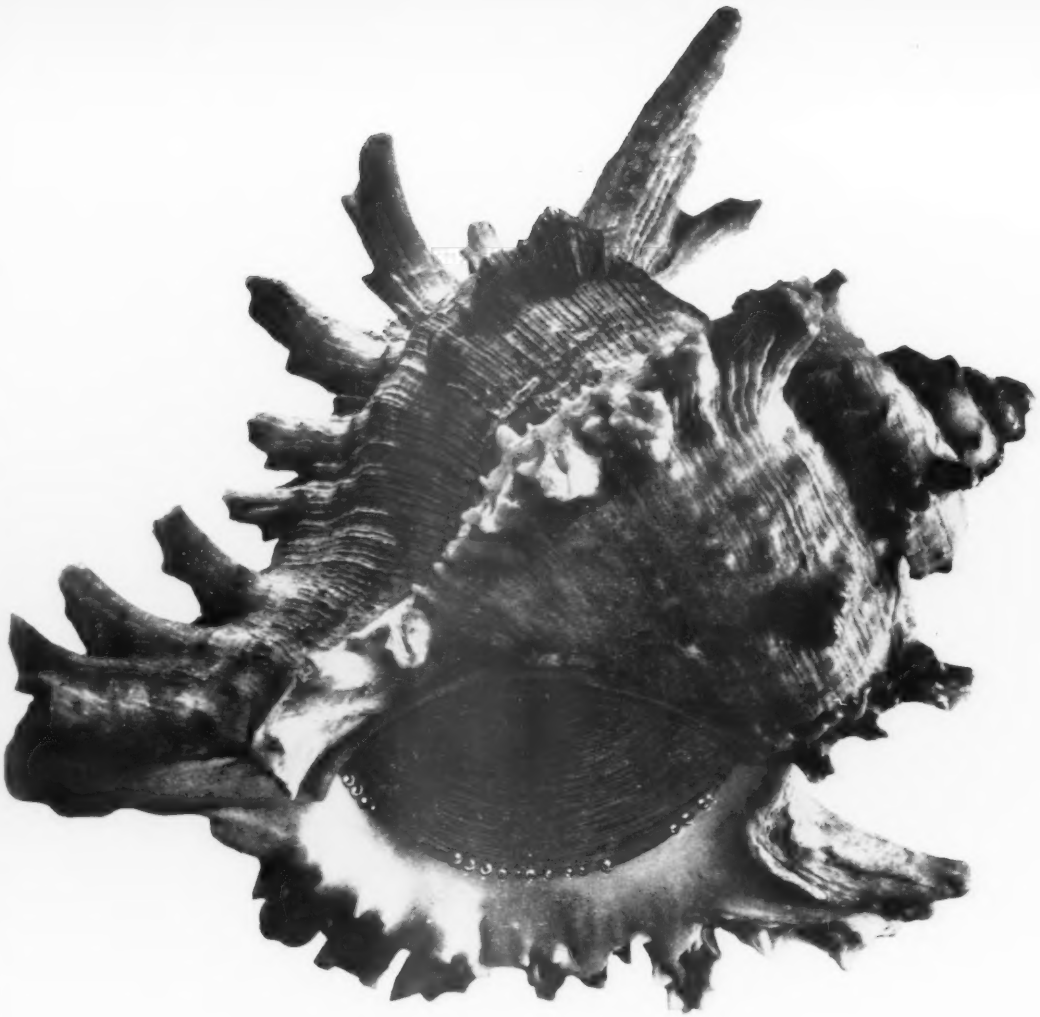

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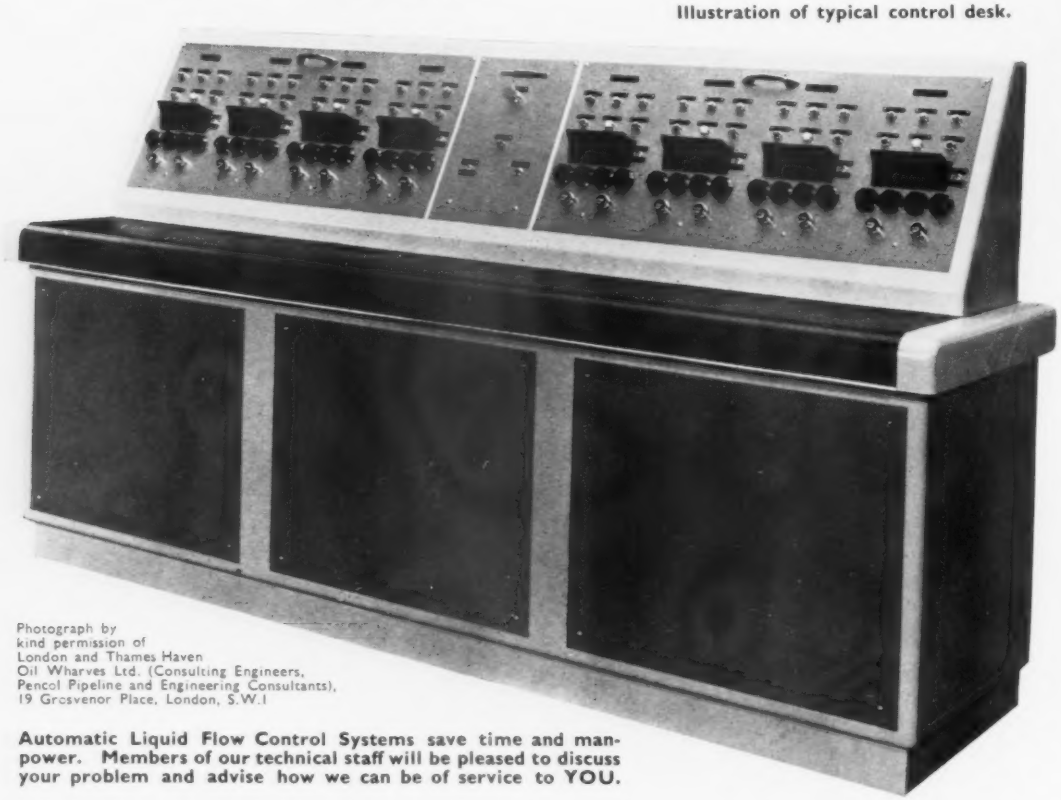

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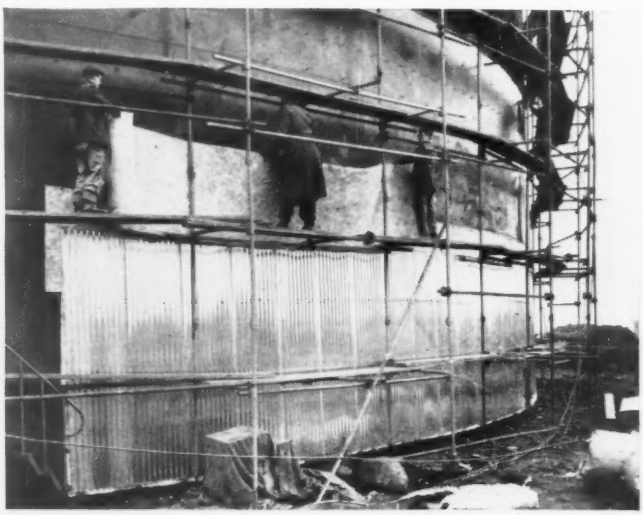

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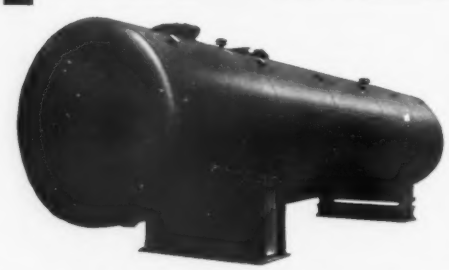

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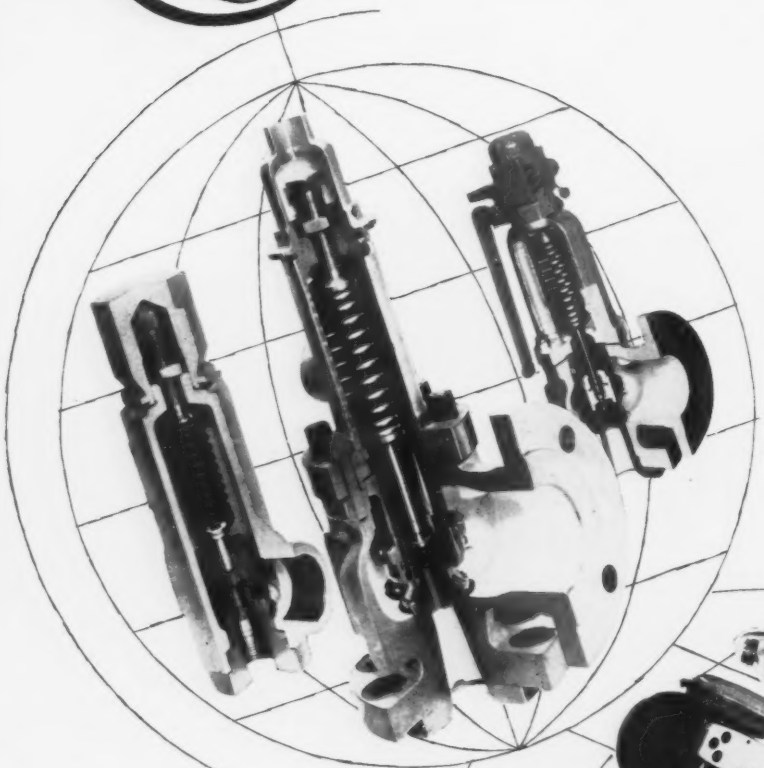

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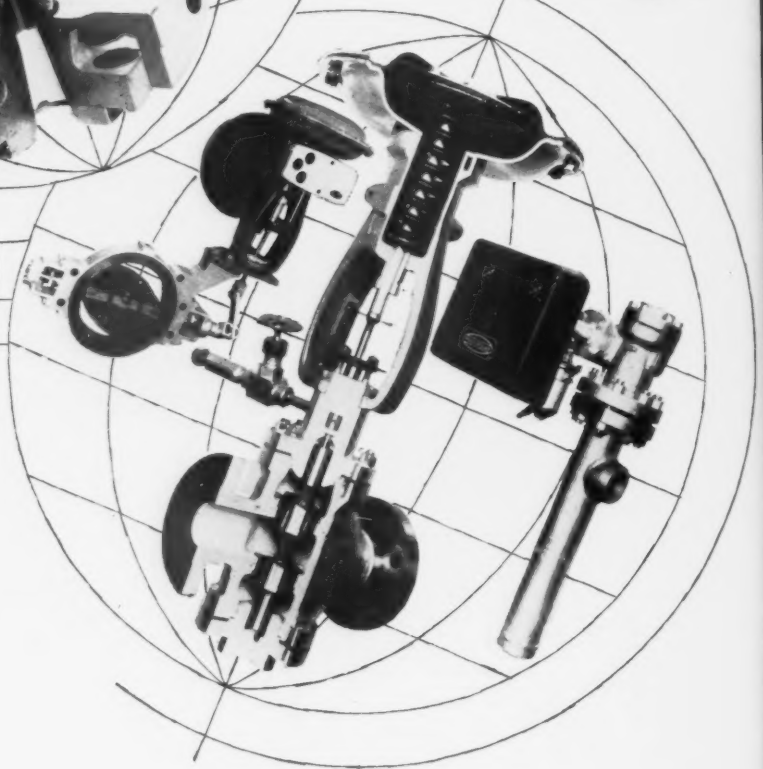

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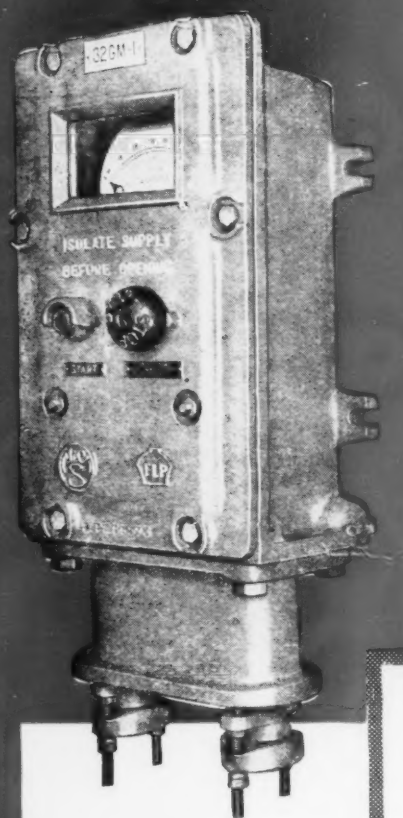

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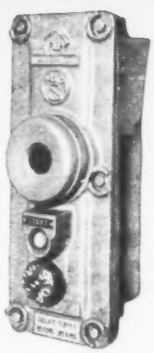

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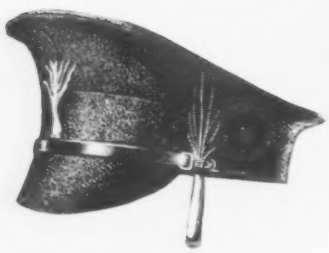

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*The Location of Refineries**

By P. H. FRANKEL† and W. L. NEWTON†

One reason why we accepted the suggestion to bring this paper, which we wrote together for the World Petroleum Congress of 1959, up to date, is that in the two years which have elapsed many things have happened, and certain trends which were then just visible, have now become fully-fledged facts which we have to know and to evaluate, especially in order to plot a future course.

When, in our earlier paper, we stated that the problem of optimum location of refineries could not be solved, this was partly due to the fact that there are a number of mostly contradictory elements which influence the people who have to decide whether a refinery should be built at one place or another.

When we embarked on this problem, we talked to people with more actual experience than we had. We talked to the chief planners of the big oil companies, and one of them said that what we wanted to do couldn't be done, because "there are no principles involved". What he really meant was that it all depended on the particular circumstances of each particular project, and that it was not possible to generalize on them. In fact, this gentleman provided us with the most valuable information, which helped to classify the motives which were relevant for the planning of location and size of refineries. What we tried to do, was to build a model of incentives. We saw, on the one side, the producing centres which are nowadays often located far from the main consuming areas. We saw this tug-of-war of motives for locating the refineries as near as possible to the oilfields and, on the other hand, locating them as near as possible to the consuming side. There were, and still are, strong arguments for either solution, and because of this they can be narrowed down to certain principles.

Principles Involved

Early on, we realized that one of the main problems involved was size. Up to certain limits, and these are not always the same, the bigger the refinery, the lower the cost per unit, provided the capacity of the refinery can be utilized to a high degree. Therefore, size itself will normally induce a planner to be nearest to the resource, because obviously the nearer the refinery is to the centre, the more countries can be supplied from this centre, and the bigger the refinery can be. It is not a coincidence that the biggest refinery ever run was the refinery in Abadan with a rated capacity of 27 million tons.

There are, however, other factors to take into consideration. These are the relationship of the yield pattern of an economically designed refinery to the pattern of consumption in the areas in which products are to be sold. Obviously, the yield patterns vary in different areas. Some, as in the United States, are gasoline based, another is fuel oil, and lately middle distillates have been playing an increasing role.

The nearer to the resource, the easier it is to take the various yield patterns of different areas of consumption into account. This was one of the great attractions of Abadan, for instance, of Aruba, Curacao, and similar large resource orientated refineries. It was particularly important in respect of Europe, which, before the last war, had a comparatively small demand for residual fuel oil, which was concentrated in bunker and specialities. The fuel oil was not a purveyor of calories, *per se;* therefore large refineries could not be built in Europe because they would have been left with too much residual fuel oil for which there was no local market. Therefore, the great and spectacular development of refining in Europe, that is to say of refineries which are known as consumer-orientated, was due to two facts—first, the volume of demand in Europe went up enormously, and secondly, for the first time there was a demand for all main products of the barrel.

*Presented to the IP Economics and Operations Group on 2 February 1961.

†Petroleum Economics Ltd.

Only if there is a demand for practically all the yields that can economically be made can refineries be built near to consuming areas. Even then the size advocated for consumer-orientated refineries, except in the biggest centres such as the United Kingdom, the north of France, or certain points of the Mediterranean, has increased less quickly than the general level of consumption.

We think reasonably economic refineries can still be built, with a throughput of 1½ to 2½ million tons/year. This is considered a small refinery to-day, but ten years ago, it was a refinery which a single company could only build in certain selected areas. If technology of refining had changed as much as the technology of tanker transportation, if a super refinery of say 20 million tons was so much cheaper per unit as is a 100,000-ton tanker compared with a 20,000-ton tanker, then a different set of refinery locations would have emerged.

Present-day Conditions

The developments of the last few years have clearly shown that above a certain size (generally about 60,000 bd or 3 million tons/year) the economies of scale became very small. It is very often necessary to build two or three units in parallel because it is no longer economic to build still bigger single units. This is one of the reasons why the increase in demand has produced not only a much bigger refining capacity, but also many more refineries.

This is due also to two other very potent reasons. One is transport. The location of refineries is very much affected by the difference, if any, of the transport costs for crude oil and for finished products. If the cost per ton of transporting the three or four major products were exactly the same as the cost per ton of transporting crude oil, there would be more reason for bigger refineries to be built further away from consuming centres. This, however, has never been the case, and the difference in the cost of transport between crude and products, has continued to grow, and is now very large. There was always the difference of tanker freight between clean and dirty tankers, which, about thirty years ago, was one of the elements which justified the construction of certain refineries in selected consumer areas. This difference between crude oil and products transport costs has grown because crude oil can be transported in much larger tankers, than, with the exception of one or two of the biggest companies, can be employed for the transport overseas of finished products.

There is, however, a second and even more potent reason; that is, the advent of inland pipelines. As pipelines cannot, at least for the time being, be used for the transport of residual fuel oil, it is better to use pipelines for crude oil which contains residual fuel oil, yet is pumpable, provided a sufficiently large refinery, or a number of refineries as is now the case, can be built at the end of a pipeline. Then full advantage will be taken of the great saving which pipeline transport offers compared with railway, road, and even river transport, and refineries can be built further inland.

This second reason obviously has political implications in that more and more countries want refineries of their own. In some cases this desire may be mistaken or exaggerated, but in some instances may be justified. At the time when we wrote the paper for the New York Congress, we dealt mainly with new European refineries at the end of pipelines, which was then the latest development. We now have the case, especially in Africa, where every new country wants a refinery. This has very serious and complicated reasons, and serious and complicated results, because it is possible that a number of so-called uneconomic refineries will be built.

Of particular interest, is the development in the location of refineries and in the meaning of the location of the refineries where, because of political pressure and the counter-pressure of the oil companies, refineries are sometimes not built in order to transform crude into products, but to control the market. Probably the first example of such refineries was the Portuguese refinery built before the last war. Somebody had the bright idea that it was possible to go to a government and say "I will build a refinery, if you will guarantee that with this refinery will go a share in the market, and if your government will help me to establish myself as a distributor, and also induce the established distributors to use this refinery as a service vehicle for themselves". This was successfully tried out in Portugal, and there have been a number of similar developments in other countries. Probably the gentleman who has developed that to a fine art is Signor Mattei of Italy who, being himself government-orientated has, in some cases, an open road to other governments. He has, for example, made deals in Morocco, Tunisia, and Ghana, of such a nature that with the refinery goes some control of the market.

This, of course, has more interesting repercussions, because to forestall this development, some of the international oil companies have agreed, and no doubt will agree in the future, to build refineries which they would not have built because they were not, without some control of the market, a paying proposition. A few years ago the chairman of one of the major companies said that some of the investments made by the company were defensive investments. If this perfectly logical business principle is accepted, it can be seen that some of the refineries which are now planned are pre-emptive refineries. That is to say, refineries which are being planned so that no one else should put a refinery down in the same place.

Cul-de-sac Refineries

We had always considered that the building of refineries at the end of pipelines running from major tidewater ports to inland centres of consumption, was a good idea and that they are perfectly justified by the two factors referred to previously, namely a consumption pattern in line with a reasonable yield pattern and the availability of sufficient local demand to justify the building of a refinery. We make the proviso, however, that it is quite unthinkable that a refinery, although justified in terms of the level of demand and the pattern of demand, could be built in an economic size if each company were to build a refinery on its own. And, therefore, we considered it entirely logical that there should be a type of joint refineries. Such a refinery was originally built in the Po Valley, where there was concentrated demand, and there are now other projects.

In our earlier paper we described these refineries at the end of pipelines as *cul-de-sac* refineries, because once the crude has been put through a pipeline to an inland destination, the operator has become a prisoner of the area of optimum outlets. Whereas, if a refinery is built at a port, there is greater mobility, and if the yield pattern doesn't fit with demand pattern at any given time, it is possible to transfer unwanted products to other areas comparatively cheaply because tanker transport is very cheap.

None of the three types of refinery which will be described later in the paper, *i.e.* the resource-orientated, the intermediate, and the consumer-orientated refineries, in themselves provide

a solution to the programme. All three types of refinery are needed in varying degrees to achieve not only efficiency, but also that flexibility which is so difficult to achieve in such a rapidly changing industry as the oil industry.

Our theory was that the base load of requirements in an area could be covered by a *cul-de-sac* refinery at the end of a pipeline, this being the cheapest method of getting from A to B into the inland consuming area, leaving, because backhauls cannot be used since it is economically impossible to escape that area, intermediate and resource refineries to supplement supplies and fill gaps left by *cul-de-sac* refineries dealing only with the base loads. We are convinced that this is a proper and workable picture of the economic process, but, of course, it can be overdone. Some of these refineries, we would not call *cul-de-sac* refineries but "dead-end" refineries because they cannot be justified by any imagination as being needed, and they are partly built or conceived in order to flatter the vanity of local notabilities, and to make more difficult the progress of the competitor. In due course consumption will probably catch up with projects which to-day are entirely uneconomic, but we have a strong suspicion that come 1970, the 1965-built, therefore 1963-planned, refineries, will be out of date, and so they will have to be built all over again.

Developments in Refinery Location

In the first part of the paper we have attempted to give a brief idea of how we see the continuous inter-action of different motivations, technical, political, and economic, and we now propose to trace the developments in the locations of refining capacity in the past, to analyse the present position, and to indicate the direction in which things are developing on the basis of projects under construction or for which concrete plans exist. Finally, it is intended to examine whether, and if so, in what areas, refinery surplus capacity exists at present, and whether, and where, there is likely to be any in the future.

In Table I is shown the growth of refining capacity outside the U.S.A., Canada, and the Soviet bloc, since 1939, and a forecast on the basis of definite projects up to 1963. The capacity shown is always given at the mid-year, although in the case of 1963, all projects which we would expect to be completed in that year, have been included in the Table, as the exact month of completion can only with difficulty be known so far ahead.

The Table indicates that the refining capacity in the area considered has grown from less than 100 million tons before the war to over 200 million tons in 1951, over 400 million tons in 1958, nearly 500 million tons in 1960, and can be expected to reach well over 600 million tons by 1963. It must, however, be remembered that there is still time for some additional projects not yet announced, to be completed by that time.

Classification of Refineries

The table also shows the breakdown by areas, of the three main types of location indicated previously. It is, perhaps, appropriate to explain in some detail the consideration on the basis of which the capacity has been allocated between the three types.

Resource capacity has been considered to be refining capacity located at or near an oilfield, which is operated for the manufacture of petroleum products for shipment to distant markets. Thus the Persian Gulf refineries, other than that part of their capacity required to meet local demand, have been classified as resource capacity. In the Caribbean area, not only the greater part of Venezuelan refining capacity but also that of the Netherlands West Indies and Trinidad, have been considered to be in the resource category, because although the crude has to be shipped a short distance, they are essentially linked to the oilfields of Venezuela, so that if one classified them as other than resource, this would result in a distortion of the analysis.

Intermediate refining capacity is capacity built neither at or near the oilfields, nor in the country of ultimate destination of the products. These refineries are largely used, either to serve a number of markets which are individually insufficient in size to justify the construction of a refinery in each of them, or they are built to retain a certain flexibility with regard to both the source of crude and ultimate destination of the products. The most typical examples of intermediate capacity are the refineries, or at least some of their capacity, in the Netherlands; at Naples, and Sicily and elsewhere in Southern Italy; also some capacity in the U.K., France, and North West Germany. Outside Europe, capacity in the Canary Islands, at Aden, and also in Australia, can be considered in the intermediate class. Some part of the capacity of plants now being built in Denmark would also probably fall into that category.

There is some difficulty in estimating the actual proportion of a country's capacity which should be classified as intermediate, and one has to be satisfied with an order of magnitude. Our guiding principle in this respect has been to base ourselves on the quantities of petroleum products exported from the country concerned, although even here it is becoming more difficult to draw a precise line as some of the capacity now being built is constructed so near the international land frontiers, that although the products may be exported in the literal sense, the refineries hardly fall into the intermediate category. For this reason the Upper Rhine refineries now projected in Strasbourg on the French side and Karlsruhe on the German side, and the Oslo refinery which either is already completed or is on the point of being completed, belong to the third category of market refineries, rather than to the intermediate class.

The third type of refining capacity, market, is, as the name implies, built in the consuming area, *i.e.* although some local transportation is required to the ultimate consumer, it does not require ocean-borne tanker movement. It is in this category that capacity which is located at or near the oilfields, but which serves the local market, has also been included.

The fact that a certain capacity has been included in one category in the tables in one year does not mean that developments may not transfer it to another in another year. A case in point, although outside the area which is the subject of this paper, is that of the United States Gulf refineries. Before the war the capacity there was of a multi-purpose nature: the refineries served many markets outside the U.S.A., those of the East Coast of the U.S. and the local markets. Now the character of resource refineries (serving distant markets) has to a great extent disappeared. There are no exports and less of these refineries' products are being sent to the East Coast. Other examples are Mexico and Burma. On the other hand there is no reason why the shift should not be in the reverse direction. In the Argentine for instance, if the Yacimientos Petroliferos Fiscales plans materialize, and the Argentine should in the course of time become an exporter of petroleum products derived from Argentine crude, some part of the capacity of the Argentine could well fall into the resource category.

Trends—Past, Present, and Future

Having thus defined the basis of our classification, let us look at the trends indicated by Table I. Whereas about two-thirds of the refining capacity of the area outside North America and the Soviet bloc was resource located before the war, by 1951 the position was about half and half. To-day it is almost the reverse of what it was before the war, well over 60 per cent of refining capacity being market located. This trend we would expect to continue, and on the basis of definite projects, we believe that no less than 68 per cent of the refining capacity in the area considered will be at the centres of consumption in 1963. The resource capacity will decline to less than a quarter of the total by that time.

The fact that an increasing proportion of the refining capacity is to-day located in the market area is largely due to the growth of consumption justifying the construction of refineries in more and more countries. Three other factors have undoubtedly played their part. First, the discovery of crude oil in new areas. We would suggest that it is unlikely that some of the new refineries would be seriously projected, at least at this moment, if it had not been for coincidence of oil having been found there. In this connexion the plants to be built in Algeria, Nigeria, and Libya, which will be mainly, if not entirely, based on newly discovered local crude, come to mind. Secondly, whereas there were once very genuine and valid foreign exchange considerations which encouraged the growth of refining capacity in consumer areas, it is often to-day, as previously mentioned, political considerations which take priority over economics. This has occurred, for instance, in Ghana, Tunisia, and also certain Central American republics, where comparatively small refineries are being built. Lastly, a factor which has also probably encouraged the development of refineries away from the oilfields, is the desire to diversify as far as the source of crude oil supply is concerned, so that the refinery should not be tied to one sort of crude, but for political and quality reasons, to a number of types of crudes.

The intermediate type of refinery is a comparatively recent development. From all the indications available, it would seem that it may only be of a temporary character. The decline in the proportion of total refining capacity in this category is again the result of increasing consumption causing refineries to move further and further forward along the route from the oilfields to the ultimate consumer. There is little doubt that the building of the new refineries linked by pipelines to the sea in inland areas of Europe, and also in Scandinavia, will lead to some weakening of the intermediate role played by refineries in the Netherlands and in the U.K. Refineries now being built in Africa are likely to have a similar effect on the intermediate type capacity in Italy and in Southern France. In the forward estimates of the intermediate capacity for 1963, it has still been assumed that the exports from the intermediate refineries in the areas just mentioned, would remain stationary. In fact, it is by no means impossible that they will decline, in which case the proportion of capacity in the intermediate class may fall still further in the next few years, than has been indicated in Table I.

Another development likely to diminish the role of the intermediate refinery is the advent of refineries, jointly constructed by a number of marketers. This again makes it possible to build refineries in consuming areas where the market share of one company alone would be, quantity-wise, insufficient to justify building a refinery of optimum, or of at least minimum economic size. This may not be without repercussion on some of the resource refineries. For instance, the construction of the refinery in Pakistan, which is a joint one by all the marketers there, would undoubtedly have some effect on the outlets for refineries in the Persian Gulf.

Projected Capacity

It is not proposed to discuss here in detail, the historical growth of refining capacities in the various areas. This is self-evident from Table I, and reflects the increase in market-orientated capacity, especially in Europe, and to a lesser extent in the Far East, Australia, and South America.

TABLE I

WORLD REFINING CAPACITY

(outside U.S.A., Canada, U.S.S.R., Eastern Europe, and China)

(*Million tons year*)

Area	*Resource*					*Intermediate*					*Market*					*Total*				
	1939	1951	1958	1960	1963*	1939	1951	1958	1960	1963*	1939	1951	1958	1960	1963*	1939	1951	1958	1960	1963*
Europe ..	—	—	—	—	—	—	14·0	33·4	37·1	39·9	18·4	55·6	131·0	157·4	213·8	18·4	69·6	164·4	194·5	253·7
Africa .	—	—	—	—	—	—	—	1·0	1·0	2·5	0·7	3·4	7·6	8·4	23·3	0·7	3·4	8·6	9·4	25·8
Middle East	16·0	41·8	47·8	47·8	47·8	—	—	3·0	3·0	3·0	1·4	5·1	11·1	13·4	15·4	17·4	46·9	61·9	64·2	66·2
Far East ..	7·8	9·3	11·7	12·3	12·3	—	—	—	—	—	2·1	5·8	36·2	44·6	67·4	9·9	15·1	47·9	56·9	79·7
Australia etc.	—	—	—	—	—	—	—	1·0	1·0	1·0	0·2	1·1	9·4	10·8	15·0	0·2	1·1	10·4	11·8	16·0
Caribbean ..	35·3	49·1	69·2	85·7	87·2	—	—	—	—	2·0	5·0	15·8	30·2	32·4	43·7	40·3	64·9	99·4	118·1	132·9
S. America	—	—	—	1·0	1·0	—	—	—	—	—	6·5	13·6	27·2	30·0	42·9	6·5	13·6	27·2	31·0	43·9
Total ...	59·1	100·2	128·7	146·8	148·3	—	14·0	38·4	42·1	48·4	34·3	100·4	252·7	297·0	421·5	93·4	214·6	419·8	485·9	618·2
Per cent of total ...	63·3	46·7	30·7	30·3	24·1	—	6·5	9·1	8·6	7·8	36·7	46·8	60·2	61·1	68·1	100·0	100·0	100·0	100·0	100·0

*Definite projects only.

It is of interest to look more closely at the geographical location of refining capacity under construction or projected. This is shown in Table II. As the data for 1960 in Table I is related to the mid-year position, capacity completed in the second half of 1960 has been included in Table II. Total definite projects for completion from 1960 onwards total 158 million tons/year, of which almost 19 million tons went on stream in the second half of 1960; the indications are that in the area outside North America and the Soviet bloc, about 40 million tons of refining capacity will be completed in both 1961 and 1962. Allowing for some additional projects still to be announced, the final increase in capacity in 1963 may be of the same order.

TABLE II

COMPLETION OF NEW REFINING CAPACITY UNDER CONSTRUCTION OR DEFINITE PROJECTS

Million tons

Area	*Second half 1960*	1961	1962	1963	1964 *and later*	*Total*
Europe	13·6	13·0	15·7	15·9	9·2	67·4
Africa	0·1	0·4	6·9	9·0	2·0	18·4
Middle East ..	0·7	—	1·3	—	—	2·0
Far East	2·5	6·6	10·7	3·0	15·5	38·3
Australia, etc. ..	—	0·7	1·5	2·0	—	4·2
Caribbean	—	9·3	5·1	0·4	—	14·8
S. America	2·0	7·2	3·1	0·6	—	12·9
Total	18·9	37·2	44·3	30·9	26·7	158·0

Over 40 per cent of the new capacity will again be in Europe, increasing at a fairly even rate of about 15 million tons/year during the 1961 to 1963 period. Of particular interest is the fact that in terms of capacity, about half of the new projects in Europe will be refineries built inland, almost all of them *cul-de-sac* refineries, at the end of long distance crude oil pipelines from the Mediterranean and the North Sea. The area next in importance as far as future capacity increases are concerned is the Far East. The main growth in capacity there will be in Japan, which will account, as far as we can ascertain, for 26 million tons, or two-thirds of the new capacity projected in the Far Eastern area. The balance of new capacity is being built in the Philippines, India, and Singapore. The figures for Africa reflect the wave of refinery construction about to begin on that continent. As has already been pointed out, some of these projects result from the discovery of local crudes and some from political motives. In addition to these definite projects, it is in Africa, in particular, that some others as yet unconfirmed, have been reported, relating to such diverse territories as the Sudan, Ethiopia, South Africa, and Rhodesia. Plans in the Caribbean area include capacity in Mexico, some of which may perhaps replace existing technically obsolete units, and in Panama, Jamaica, and some of the smaller Central American republics. The additions in capacity in South America will take place mainly in the Argentine and Brazil, and there are also a number of unconfirmed projects not included in our figures.

Capacity and Demand

Finally, it is perhaps pertinent to ask how the existing and projected refining capacity compares with requirements, *i.e.*, whether there are, or are likely to be, any refinery capacity surpluses or shortages. Taking the area outside North America and the Soviet bloc as a whole, there was a refinery capacity in 1960 of 486 million tons, as compared with a 1960 demand in terms of crude equivalent which we would estimate at something between 410 and 420 million tons. Allowing for net exports of petroleum products from the area, i.e., exports to North America less imports from the Soviet bloc of about 30 million tons, and for the fact that owing to necessary maintenance shut-downs, operation at 90 per cent of rated capacity is considered normal, it can be concluded that in 1960 the refinery capacity of the area was about in balance with requirements. It should however be mentioned that had it not been for the exceptional and even quite unexpected increase in demand in 1960, especially in Europe and Japan, there is little doubt that some refining capacity would have been under-employed in some of the inland refineries in Europe in particular during the second half of 1960.

Regarding the future outlook, and again basing ourselves only on definite projects, the refining capacity of the area will in 1963 total 618 million tons. Compared with this we estimate that demand in 1963, expressed in terms of crude equivalent, may be just over 500 million tons. Assuming again a net export of 30 million tons, and operation at the rate of 90 per cent of capacity, this would indicate a small surplus in that year of perhaps 20 or 25 million tons of refinery capacity. Such a surplus could well be considered to be within the margin of error, looking so far ahead, and demand may perhaps, as in 1960, again take care of it. On the other hand, some unconfirmed projects could still become definite, and others may yet be announced. Should there be a surplus of capacity, we would expect to find it in the resource refineries, probably mainly in the Caribbean area.

HAMBURG SYMPOSIUM ON GAS CHROMATOGRAPHY

The 4th International Symposium on Gas Chromatography organized by the Analytical Chemical Division of the Gesellschaft Deutscher Chemiker and The Gas Chromatography Discussion Group of The Hydrocarbon Research Group of the Institute of Petroleum, being also the 41st meeting of the European Federation of Chemical Engineering, will be held at Hamburg from 13–16 June 1962, inclusive.

The main language of the meeting will be English, and the papers submitted for presentation should be in a form similar to those at the former Symposia on Gas Chromatography, and will be classified under three headings: Theory; Apparatus and Techniques; and Applications.

Those papers concerning the application and the technique will need to have some novel feature to warrant their inclusion in the programme.

Preliminary registration for attending the symposium should be sent as soon as possible to: Gesellschaft Deutscher Chemiker, c/o Dr W. Fritsche, Frankfurt/M, Postfach 9075, Germany.

An early registration is necessary so that further information circulars and the final registration form can be sent out.

IP Council Members 1961-62

Julian M. Leonard, who is to serve a second term as President of the Institute

At the Annual General Meeting of the Institute on 3 May, Julian M. Leonard was unanimously re-elected President to serve for the Session 1961–62.

MEMBERS OF COUNCIL

At the same meeting, the following were declared elected to fill seven vacancies on the Council:

W. S. Ault, B.A.
F. N. Beaumont, B.Sc.(Eng.), M.I.Mech.E., M.I.E.E.
J. M. Dougary, B.Sc., F.R.I.C., A.M.I.Chem.E.
R. H. W. Hamilton, M.A.
H. Hyams
J. S. Parker, M.A., B.Sc.
D. L. Samuel, B.Sc., A.R.I.C.

W. S. Ault, B.A., who joined Shell in 1936, spent his first three years with the Group at the Shell Haven refinery and then moved to the Suez refinery of Anglo-Egyptian Oilfields Ltd. On his return to Britain in 1944, he became assistant refinery manager at Stanlow, where he remained for the next two years. He then became technical adviser to Shell-Mex and B.P. Ltd. In 1949 he was appointed manager of the Shell Petroleum Company's Sales Technical Advisory Department, and in 1952 he took up his present position as manager of the Technical Department of Shell-Mex and B.P. Ltd.

W. S. Ault

Mr Ault was a Member of Council of the Institute from 1948 to 1958 and a vice-president in 1958–59. He has also for some years past been a Member of Council of the Motor Industry Research Association.

F. N. Beaumont, B.Sc.(Eng.), M.I.Mech.E., M.I.E.E., F.Inst.Pet., studied at University College, Southampton, and University College, London, graduating in 1924 with an honours degree in engineering. After electrical research work under Sir Ambrose Fleming in London, he entered the British Thomson-Houston Company at Rugby in 1926 as a student apprentice. In 1929 he joined the London Power Company of the electricity supply industry as protective gear engineer, becoming deputy distribution engineer in 1936, a position he held during the war years. In 1947 he joined the Engineering Department of The British Petroleum Company, becoming chief electrical engineer in 1948, superintendent engineer, utilities, in 1953, and manager, engineering development division in 1958.

F. N. Beaumont

Mr Beaumont has played a leading part in the development of electrical systems and equipment for the oil industry and their associated safety aspects as chairman of the OCMA Electrical Panel and the IP Electrical Sub-Committee since 1953. He is chairman of the OCMA Panels on Air Conditioning and Corrosion Control. He was elected a Fellow of the Institute in 1955 and has been a member of the Engineering Committee since 1953. He has been an active member of British Standards and Electrical Research Association committees dealing with flameproof and intrinsically safe electrical equipment.

J. M. Dougary, B.Sc., F.R.I.C., A.M.I.Chem.E., F.Inst.Pet., took an external degree from the University of London, graduating with Honours in Special Chemistry. He joined the Anglo-Iranian Oil Company in Abadan in 1935, and for the next ten years was employed in a wide range of work, mainly concerned with the production and refining of aviation gasoline and included commissioning and development work on the various new plants which were put into operation during this time. As a senior development chemist at the end of this period, Mr Dougary was technical assistant to the works manager and general refineries manager.

J. M. Dougary

At the beginning of 1946 he was posted to the Kuwait Oil Company as superintendent Oil Storage and Export Division for the commissioning of the new loading terminal and associated facilities. In 1951 he was appointed assistant superintendent Pipeline and Export Department, involving additional duties concerned with the operation and maintenance of crude oil pump stations and pipeline construction.

He became head of the Operating Services Group in Kuwait five years later, being concerned with the supervision of stores, transport, personnel services, and fire protection, and in June 1959 was appointed assistant general manager (personnel and relations) first in Kuwait, and then in November 1959 in London.

In January 1961 Mr Dougary assumed responsibility for all Kuwait Oil Company's oil operations in London and was designated assistant general manager oil operations.

R. H. W. Hamilton, M.A., who is manager, Production Division of the Iraq Petroleum Co. Ltd and its associated companies, joined Shell straight from Cambridge in 1928, becoming an administrative assistant with Sarawak Oilfields Ltd. After five years training in the Miri and Seria oilfields, he moved to B.P.M. in The Hague and then to Astra Romana in Rumania.

R. H. W. Hamilton

In 1934 he went to the U.S.A. where he worked for Shell in California and the Middle West, specializing in oil property management and lease evaluation. Subsequently, he joined the Shell head office in London, before transferring to the Iraq Petroleum Co. Ltd head office in 1938. After war service with the R.N.V.R., Mr Hamilton returned to the Iraq Petroleum Company in London, transferring later to the exploration headquarters in Tripoli. He returned to head office in 1950.

He has been a Member of Council since 1959.

H. Hyams, joined the Asiatic Petroleum Co. Ltd in 1919 and played an active part in the development of the sales technical activities of the Shell Group before retiring in 1958.

H. Hyams

Mr Hyams was elected a Fellow of the Institute in 1932. Including three terms of office as a vice-president, he has been a Member of Council since 1944. Mr Hyams is widely known for his work on the standardization of oil measurement and is an honorary member of the Standardization Committee. He has also served on committees dealing with by-laws, the house, public relations, and publications. He was awarded the Eastlake Medal in 1956, and in 1957 was elected an honorary member of the American Society for Testing Materials Committee D-2 on Petroleum Products and Lubricants in recognition of his work in making possible the joint publication of the *ASTM–IP Petroleum Measurement Tables*.

J. S. Parker, M.A., B.Sc., served as the manager of Lobitos Oilfields Ltd's refinery at Ellesmere Port, Cheshire from 1933 to the end of 1958 when he retired from the position although remaining with the Company in a consultative capacity.

J. S. Parker

Joining the Institute in 1923, he was a founder and committee member of the Northern, Stanlow, and Trinidad Branches, and served twice as chairman of the Stanlow Branch.

Mr Parker first became a Member of Council in 1945, and has served continuously as either a vice-president or member of Council since that date. Soon after his election he became a member of Publications Committee and continued prominently in this role through the years. At various times he has also been a member of committees on branches, by-laws, education, election, engineering, house, public relations, and standardization. He was awarded the Eastlake Medal in 1958.

D. L. Samuel, B.Sc., A.R.I.C., was educated at Grocer's Company School and East London College (now Queen Mary College) University of London. Mr Samuel graduated B.Sc. (Hons. Chem.), and was elected an Associate of the Royal Institute of Chemistry in 1921.

D. L. Samuel

He joined the Shell Group as a chemist in their Central Laboratories in 1927 and remained with them until the end of 1960. Of this time 12 years was spent as a chemist in the Laboratories and the remaining years as a technical adviser at Head Office. In January 1961 he joined Pergamon Press in a senior editorial position.

Having joined the Institute of Petroleum in 1924, he was a Member of Council from 1948 until 1960. He has been a member of Publications Committee and of Papers Subcommittee since 1948, becoming chairman of Papers Subcommittee and honorary associate editor in 1954.

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IP ENGINE TESTS FOR RATING FUELS

It has been found necessary to make important amendments in the engine test methods for rating fuels as published in the second edition of Part II of "IP Standards" (October 1960). These amendments are:

(*a*) To increase the tolerance allowed on standardization fuel ratings from ± 0·3 ON to ± 0·4 ON for the Extended Motor Method (IP 150/60) and for the Extended Research Method (IP 172/60)T.

(*b*) To replace the spark advance micrometer reading relationship given for the Motor Method and for the Extended Motor Method by those given in the 1960 ASTM Manual for Rating Motor Fuels.

(*c*) In Supplement II to amend the capacities of the three types of crankcase to the correct figures.

An amendment sheet giving full details of the changes is available from the offices of the Institute.

The President congratulates George Sell

Professor Garner receiving the Honorary Fellowship

The Institute Awards

The first item on the agenda of the Ordinary General Meeting of the Institute held on 3 May, which followed the Annual General Meeting, was the presentation of Institute of Petroleum Awards to two who have records of long and distinguished services to the Institute, particularly in the sphere of its publications. The Eastlake Medal was presented to George Sell, and Professor F. H. Garner was awarded the Honorary Fellowship.

THE EASTLAKE MEDAL

Presenting the Eastlake Medal to George Sell, the President, **Julian M. Leonard,** said:

"George Sell joined the firm of Arthur W. Eastlake, after whom this Medal was named, in the year 1910, and as specialization was almost unheard of in those days, he was put to work on all and every problem that happened to come along. In the year 1913 the Institution of Petroleum Technologists was formed and the spade work of getting a new scientific Institute launched on sound progressive lines, with all its legal, financial, and administrative problems was largely done in Mr Eastlake's office. It can, therefore, be fairly claimed that George Sell was active on the Institute's behalf long before the Institute itself was actually founded.

"When Mr Eastlake became the honorary secretary, George Sell became not exactly the power behind the throne, but rather the unpaid maid-of-all-work. After a distinguished war career in the Middle and Far East, where he finally became one of the best-known staff corporals on the coast, in the troop transport office in Bombay, he joined the Institute's staff in 1923, where he remained until his retirement this year, except for a short spell as associate editor of *Petroleum Times* and a rather longer spell in World War II, when he became the terror of all motorists wishing to obtain a gallon or two of petrol for dubious purposes.

"All these facts show that George Sell is an old and loyal servant of the Institute, but in themselves they would not have earned him the unanimous award by the Council of the Eastlake Medal.

"The award calls for outstanding services to the Institute and this is exactly what George Sell gave, year in year out for over thirty years. He built up the publications of the Institute from merely the *Journal* in 1923 to that of a considerable publishing house by 1961. Perhaps his greatest success was the foundation and development of the *IP Review*, now by far the Institute's most popular publication. Started under conditions of the greatest difficulty just after the war, George Sell gradually built it into the highly successful periodical it now is: twice its original size and nearly three times its early circulation. Of course, many other people have done the most valuable work in building up the Institute's publication division. Dr Dunstan, Professor Garner, and Dr Evans have all been outstanding honorary editors, but the man on whose shoulders has fallen the tremendous task of compiling and gathering in the copy, meeting the deadlines, pleading with authors, costing out the editions and doing it all with a meticulous regard for accuracy of detail, a love of the English language, and complete loyalty for everything the Institute of Petroleum stands for in the science and technology of petroleum, is

The President talks to the two award winners at the dinner after the meeting

George Sell, and well and truly has he merited the award of The Eastlake Medal."

Mr Sell, after receiving the medal, replied:—

"I thank you, sir, for your very generous references to my part in the affairs and work of the Institute and you, ladies and gentlemen, for your kind reception of those remarks.

"I am deeply conscious of the honour which has been conferred upon me by the award of the Eastlake Medal. To me it has a very special significance because of its association with the name of Arthur W. Eastlake, one of the founders of the Institute and for many years its honorary secretary. He was my employer for nearly twenty years and was in partnership with Sir Boverton Redwood.

"It was early in my career that Sir Boverton and Mr Eastlake, took active steps to form the Institution of Petroleum Technologists, the predecessor of our Institute. It is, however, of interest to record that even as early as about 1904 Mr Eastlake had proposed the formation of an Institution of Petroleum Engineers.

"My first efforts for the Institution were of minor importance, but as time went on I became more and more involved. It has been my good fortune to have worked with all the honorary officers, and in particular with the honorary editors and honorary associate editors. To all of them I would like to express my thanks for their help, for their forbearance, and for their consideration. Working with them has indeed been a great pleasure. I would also wish to thank the staff of the Institute for their help and understanding at all times.

In the foreground, four holders of the Eastlake Medal

"I have seen the Institute grow from a small body to become an organization with considerable repute throughout the petroleum industry. One important aspect of its growth has been the formation of the branches. It has been my pleasure to visit most of the branches and to see at first hand the interest which their members take in IP affairs.

"Throughout my career the Institution and the Institute have been my absorbing interest. And in the future, in whatever field of activity I may find myself, the Institute will still remain a major interest to me.

"If I have been of any service to the Institute, or to the industry, I have been happy to be so. In the course of my work I have made many friends in the petroleum industry, and from them have received much help and benefit. So, Mr President, I would conclude by asking that my thanks to them be recorded and to assure them, and the Institute, that 'George' is still at their service."

THE HONORARY FELLOWSHIP

Mr Leonard, asking Professor Garner to accept the Honorary Fellowship of the Institute, said:

"Professor Garner became interested in chemistry at an early age, and to develop this interest he went up to Birmingham University to take his B.Sc. degree. As the names of Garner and Birmingham University are to most people synonymous, it would be excusable to think that he had always worked at this University, but in fact he was appointed a Fellow of the Mellon Institute of Industrial Research in Pittsburg, U.S.A. in 1919, and in 1921 joined the AGWI Petroleum Co. Ltd at Fawley as chief chemist and remained with the Esso Company for twenty-one years, working mainly in the research field. He received the O.B.E. in 1942 and the U.S. Medal of Freedom, Silver Palm, in 1943 for his services to the war effort.

"He decided in 1942 to leave the industry and enter the academic world. At that time there was a very small school of oil technology at Birmingham, and in 15 years Professor Garner had built up a Chemical Engineering Department that was famous throughout the country.

"Professor Garner joined the Institute of Petroleum in 1921 and was particularly active in the standardization and publications fields, becoming honorary associate editor in 1937 and honorary editor of the Institute in 1946. Professor Garner was elected to Council in 1930 and was elected President of the Institute from 1944 to 1946. He was awarded the Redwood Medal in 1951.

"For his lifetime's service to the technology of oil and his tremendous services to the Institute for a period of over 40 years, Professor Garner has been awarded the Honorary Fellowship of the Institute of Petroleum."

After signing the book **Professor Garner** said how much he appreciated the honour, for quite a large part of his life had really been intertwined with the Institute from the time he joined.

* * *

REDUCED SUBSCRIPTIONS FOR RETIRED MEMBERS

The Council of the Institute has been giving some thought to the possibility of introducing a special scheme for retired members to continue their membership at a reduced annual subscription, provided they have been associated with the Institute for a considerable period of time and have retired from a full-time position in the industry.

A scheme has now been approved and will come into force from 1 January 1962.

Any member of the Institute of Petroleum may apply to the General Secretary to continue his membership of the Institute at an annual subscription of £1 1*s* 0*d* per annum, whilst continuing to receive all the rights and privileges of full membership, providing the following conditions are fulfilled:—

(*a*) The member must have retired from full employment in the industry.

(*b*) The member must be 65 years of age and have been a member of the Institute of Petroleum for a period of not less than 20 years,

Around the Branches

ABADAN, BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD, YORKSHIRE

C. Billingsley

South-Eastern Branch

Branch officers for 1961–62 were elected at a committee meeting held on 19 April. The chairman for the session is C. Billingsley, with F. W. Martin as vice-chairman. D. K. L. Morgan was again elected secretary, and L. J. Challis will serve as treasurer.

London Branch

Summer Outing

Early on Friday, 28 April, 37 members of the London Branch together with their ladies assembled at Victoria to begin stage one of their first overseas summer visit.

The Institut Français du Pétrole had very graciously invited the London Branch to visit their laboratories at Rueil-Malmaison, an opportunity which could not possibly be missed. The party travelled by chartered aircraft from Lympne Airport in Kent to Beauvais, where they boarded a coach to take them to Rueil-Malmaison on the outskirts of Paris. The Institute was reached just before 1 pm, and the director, Mon. R. Navarre, and members of his staff were waiting to greet them.

Drinks were served in the headquarters of the Institute, which are set in delightful surroundings, and the party were then entertained to a very generous luncheon. This provided an excellent opportunity of meeting and becoming acquainted with members of the various departments working at Malmaison.

Following the lunch M. Navarre made an admirably phrased and entertaining speech of welcome to the London Branch of the Institute of Petroleum which was replied to by Stan Price, the Chairman of the London Branch, in French. It is not impossible that the sense of this speech was lost in the translation but the English version said that the London Branch welcomed this opportunity to visit the Institut Français du Pétrole, an organization unique in its size and in the scope of its activities. It was certain that members of the London Branch would return to London with a much better appreciation of the value of the work being carried out in France for the advancement of research in the technology of petroleum generally. The Chairman also expressed his thanks to M. Navarre and his staff for their kind hospitality and for the opportunity of seeing their Institute in Paris during the springtime of the year.

Following this, the male members of the party were shown a short film of the Institute's activities and then conducted in groups over the laboratories.

The objectives of the IFP as written in its articles are threefold:—

1. To originate and carry out the studies and the research work leading to the extension in France of scientific data and of industrial developments;
2. To instruct engineers and trained personnel capable of taking part in the development, in the dispersion and in the effective application of fresh knowledge;
3. To inform the government departments, the industry, and the engineering profession of the scientific knowledge and industrial techniques that may affect the country's economics.

Management is entrusted to a general manager assisted by a Board composed of industrialists, Government delegates, and scientific personalities and is supervised by a Government delegate and State Comptroller. The Institute incorporates the French National Graduate School of Petroleum.

A staff of some two thousand is occupied at the Institute, of whom about two-thirds are graduates. Its operating budget is maintained by a fee which is part of the price structure of petroleum products in France.

The great range of subjects of research and study at the IFP extends from sedimentary geology through drilling, production, chemistry, refining, engineering, analysis, and synthesis, to applications.

During this time the ladies of the party were taken to see the very attractive adjoining Chateau de Malmaison, a country house built for Napoleon in 1798 and containing many relics of the Emperor and his consort Josephine.

The party met up again at the Institute in the evening where it was found that pineapple juice suitably diluted with champagne was an excellent refreshment. After saying reluctant farewells to their hosts the party left Malmaison for their hotel in Paris.

No formal arrangements were made for members during the evening but parties distributed themselves throughout the city. The following morning many members took themselves on sightseeing tours of Paris while others who had perhaps enjoyed themselves too well the evening before seemed to be keeping well in the shade of the trees in the Champs Elysee.

At 4 pm the party reassembled at the hotel to be taken by coach to Beauvais airport and so back to London, which was reached in the evening by a tired but very happy party, after a notably successful and enjoyable visit.

On arrival in Paris the party was welcomed by M. Rene Navarre seen in (2) *with J. H. M. Clark, chairman of the Branch* (*left*) *and Stan Price, immediate past-chairman and organizer of the meeting. They had left Lympne* (1) *at an early hour, travelled by DC-3* (3) *to Beauvais, and were entertained with refreshments* (4–6) *before lunch* (7–9) *in the headquarters of the IFP. The afternoon was spent in an inspection of some of the laboratories* (10–12). *The group includes most of the party about to start the coach journey from Beauvais to Paris*

The London Branch Summer Outing

Photos by George Sell

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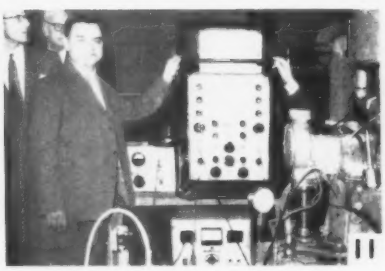
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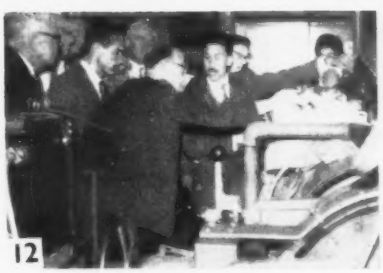
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Seventeen Per Cent Increase in U.K. Oil Consumption in 1960

U.K. oil consumption, excluding foreign bunkers, rose by 16·9 per cent in 1960 to over 42½ million tons. This figure, given in the latest PIAC statistics published by the Petroleum Information Bureau, compares with a figure of 36,514,615 tons in 1959.

Fuel oil consumption showed the greatest increase among the major products. Total consumption of 17,437,805 tons was more than a quarter as much again as in 1959. All types of consumer contributed to the increase, but among the larger users the highest percentage rises were for central heating, steam raising (including public electricity generation), and the glass and ceramics industries.

Consumption of gas diesel oil rose by 416,681 tons to 3,540,158 tons. This represented an increase of 13·3 per cent and compared with a rise of 4·6 per cent the previous year. Its growing use for central heating and rail traction accounted for a substantial part of this increase. But figures for agricultural power units, marine craft, and stationary oil engines were also noticeably higher. Consumption of gas diesel oil by gasworks continued to decline, however, as the use of light distillate feedstocks and petroleum gases was extended.

Steam raising for electricity generation again achieved the largest overall increase in the use of black oils of any end use sector. Consumption rose by 1,237,015 tons, or 29·8 per cent, to 5,391,218 tons. This compared with an increase of 1,518,772 tons in 1959.

Consumption of motor spirits rose by 7 per cent to 7,625,184 tons. Demand for premier grades was 14 per cent higher, while that for standard grades fell. Deliveries to dealers increased by 9·6 per cent but the growing preference for diesel engines caused a drop in consumption by commercial users. The demand for derv fuel was 13·5 per cent above the 1960 figure.

Among other products, an increase of 91,790 tons of burning oil to 1,294,908 tons was almost entirely offset by a further decline of 79,961 tons in demand for vaporizing oil as tractor fuel to 289,208 tons. Consumption of aviation fuels rose by 135,390 tons to 1,763,815 tons.

TABLE I

U.K. DELIVERIES INTO INLAND CONSUMPTION OF PETROLEUM PRODUCTS

(in tons)

	1938	1953	1956	1959	1960
Aviation fuels (a)	112,549	1,184,000	1,753,996	1,628,425	1,763,815
Motor spirit (incl. motor benzole)					
Dealers:					
Premier grades	2,790,326	2,197,254	2,929,191	4,050,555	4,623,586
Standard grades		1,578,260	1,541,070	1,576,127	1,542,603
Commercial consumers:					
Premier grades	2,040,000	255,378	336,289	404,705	464,099
Standard grades		1,709,063	1,517,104	1,092,182	994,896
	4,830,326	5,739,955	6,323,654	7,123,569	7,625,184
Industrial spirits (incl. industrial benzole)	38,366	100,917	148,071	207,123	229,824
White spirit	72,057	140,998	155,593	156,073	152,543
Kerosine:					
Burning oil	543,000	546,708	830,808	1,203,118	1,294,908
Vaporizing oil	177,676	833,051	574,175	369,169	289,208
	720,676	1,379,759	1,404,983	1,572,287	1,584,116
Derv fuel	387,059	1,270,773	1,797,139	2,275,803	2,582,186
Gas, diesel, and fuel oils:					
Gas diesel oil	797,000	1,717,175	2,387,490	3,123,477	3,540,158
Fuel oil...	628,000	3,815,290	6,471,209	13,811,874	17,437,805
Refinery consumption ...	183,000	1,508,491	2,157,170	3,078,518	3,342,984
	1,608,000	7,040,956	11,015,869	20,013,869	24,320,947
Lubricating oils and greases ...	561,000	794,238	894,199	927,670	964,842
Paraffin wax and scale	48,121	40,053	52,335	51,370	53,623
Propane and butane	2,400	53,164	68,395	125,823	153,973
Bitumen	607,132	749,526	940,934	990,927	1,062,405
Other products (b)	—	508,356	667,581	1,441,676	2,202,579
TOTAL	8,990,686	19,002,695	25,223,049	36,514,615	42,696,037

(a) From 1948 includes aviation turbine fuel. (b) Mainly feedstock for petroleum chemical plants.

TABLE II

ESTIMATED END USE OF CERTAIN PETROLEUM PRODUCTS

(in thousand tons)

	1954	1959	1960
Motor spirit:			
Cars and motor cycles	2,700	4,212	4,723
Taxis	80	27	26
Public service vehicles	140	85	82
Goods vehicles	2,160	2,050	2,050
Industrial use	190	210	215
Agricultural use (including vans)	260	220	220
Services and other Government departments	335	280	270
Petroleum industry own use	28	18	17
Miscellaneous	29	22	22
Total	5,922	7,124	7,625
Derv fuel:			
Public service vehicles	850	832	840
Goods vehicles	525	1,389	1,683
Petroleum industry own use	23	33	36
Miscellaneous	15	22	23
Total	1,413	2,276	2,582
Burning oil:			
Farming	37	16	15
Industrial and railways	57	48	50
Services and other Government departments	55	35	27
Domestic heating, lighting and cooking	455	1,104	1,203
Total	604	1,203	1,295
Vaporizing oil:			
Agricultural tractors	655	342	265
Agricultural stationary engines	18	8	7
Fishing	14	5	3
Industrial	20	14	14
Total	707	369	289
Lubricating oil and greases:			
Aviation	—	9	10
Industrial	—	503	520
Marine	—	80	73
Motor	—	298	325
Tractor	—	38	37
Total	—	928	965

There was a remarkable growth in demand for chemical feedstock, included in the PIAC statistics for the first time, which totalled 1,562,000 tons, some 46·4 per cent above the 1959 figure of 1,067,265 tons. Of other leading products bitumen and lubricants showed modest increases of 71,478 tons and 37,172 tons respectively.

Trend since 1938

Table I, which, in common with other accompanying tables, is based on statistics included in the PIAC booklet and on tables issued in conjunction with it by the Petroleum Information Bureau, shows that U.K. consumption of petroleum products has more than doubled since 1953, the 1960 total of 42,696,037 tons being 124·7 per cent above the 1953 level of 19,002,695 tons. Since 1938 consumption has increased some four and a half times.

Use of black oils has shown an even more spectacular rise, the 1960 figure of 24,320,947 tons being more than three times the 1953 figure of 7,040,956 tons, which in turn represented a four-fold increase over the 1938 level of 1,608,000 tons.

The large increase in U.K. refinery capacity during recent years is reflected in Table IV. Output of refined petroleum products has risen from 2,391,722 tons in 1938 to 44,465,240 tons in 1960. The 1960 figure is some 5,329,000 tons higher than the 1959 output and ten times that of 1948, when British refineries produced 4,461,567 tons of products.

TABLE III

UNITED KINGDOM

INDIGENOUS MATERIALS MADE AVAILABLE FOR DISTRIBUTION BY THE PETROLEUM INDUSTRY

(excl. Shale and Indigenous Crude)

(in tons)

	1959	1960
Motor spirit (by low-temperature carbonization)	5,639	5,537
Refined benzole	265,023	290,025

TABLE IV

UNITED KINGDOM

PRODUCTION OF PETROLEUM PRODUCTS EX IMPORTED AND INDIGENOUS CRUDE AND PROCESS OILS (incl. SHALE)

(in tons)

Product	1938	1948	1958	1959	1960
Motor and aviation spirit	316,531	610,802	6,750,648	7,531,348	7,917,036
Industrial spirits	2,585	3,950	1,791	1,674	4,666
White spirit	27,181	43,028	142,582	139,457	161,960
Burning oil	121,036	110,508	1,083,098	1,601,326	2,180,102
Vaporizing oil	6,337	10,337	208,923	171,414	103,517
Gas/diesel oil	377,537	907,229	6,284,658	7,240,974	7,647,965
Fuel oil	454,402	1,396,626	12,572,351	15,598,630	18,532,814
Refinery fuel consumption (ex own production)	190,000	337,244	2,503,445	3,032,084	3,289,753
Bitumen	612,609	523,227	859,526	961,248	1,037,044
Paraffin wax, scale, and slack wax	11,843	14,124	30,527	30,522	36,453
Lubricating oil	157,805	365,831	751,411	863,284	912,030
Propane and butane	1,600	15,038	90,711	125,897	154,302
Miscellaneous products and loss	112,256	123,623	1,653,567	1,838,379	2,487,598
Total	2,391,722	4,461,567	32,933,238	39,136,237	44,465,240

TABLE V
UNITED KINGDOM
INLAND END USE OF GAS OIL, DIESEL OIL, AND FUEL OIL
(in tons)

End Use	1938	1948	1958	1959	1960		
					Gas Diesel	*Fuel Oil*	*Total*
Burning:							
Central heating:							
Private houses	20,000	24,900	136,392	168,626	230,939	11,872	242,811
Other premises	225,000	228,985	1,769,298	2,207,033	560,433	2,373,945	2,934,378
Bakeries	65,000	61,146	123,650	130,667	24,887	118,468	143,355
Glass	91,000	205,936	295,582	340,853	26,916	409,046	435,962
Ceramics (a)	—	—	124,966	166,142	14,041	221,830	235,871
Steel manufacture:							
Open hearth	—	544,907	1,081,180	1,304,745	1,451	1,557,337	1,558,788
Other	—	256,958	664,397	714,781	67,703	794,097	861,800
Industrial furnaces:							
Metallurgical	325,000	227,651	352,478	370,145	65,324	350,732	416,056
Other	55,000	103,564	404,333	424,184	96,200	362,141	458,341
Agricultural driers and heaters (b) ...	—	—	71,458	64,016	51,489	34,858	86,347
Steam raising—Public electricity generation	103,000	979,919	2,581,726	4,154,203	9,508	5,381,710	5,391,218
Steam raising—Other			2,776,694	3,467,166	80,347	4,129,405	4,209,752
Power:							
Agricultural power units	6,000	36,481	457,129	516,226	557,865	6	557,871
Marine craft	65,000	251,006	935,931	976,395	335,727	720,665	1,056,392
Rail traction:							
Railways	7,000	47,407	80,009	140,839	238,791	3,111	241,902
Industrial		10,438	16,664	24,367	37,132	662	37,794
Stationary oil engines:							
Public electricity supply	17,000	40,055	62,232	61,188	38,468	31,706	70,174
Other	196,000	224,323	343,605	351,690	397,616	16,019	413,635
Mobile diesel engines	43,000	167,361	375,833	398,308	396,795	24,292	421,087
Manufacture:							
Gas making	130,000	469,798	665,094	519,519	235,649	163,727	399,376
Other manufacturing	32,000	47,642	66,182	244,815	47,745	556,096	603,841
Refineries' own use (inc. ex own production)	218,000	422,179	2,531,830	3,078,518	—	3,342,984	3,342,984
Petroleum industry's own use... ...		105,259	184,345	189,443	25,132	176,080	201,212
Government (c)	10,000	75,495	—	—	—	—	—
Total deliveries	1,608,000	4,531,410	16,101,008	20,013,869	3,540,158	20,780,789	24,320,947

(a) Included under "Other Manufacture" before 1951.
(b) Included under "Steam raising—Other" before 1951.
(c) Included under appropriate consumption categories after 1950.

MIDDLE EAST OIL PRODUCTION

	April	*Jan.–April*
	Tons	
Iraq Petroleum Co. Ltd ...	2,959,410	11,956,591
Basrah Petroleum Co. Ltd ...	782,094	3,173,850
Mosul Petroleum Co. Ltd ...	107,114	430,511
Qatar Petroleum Co. Ltd. ...	664,911	2,702,817
Iraanse Aardolie Exploratie en Productie Mij	4,213,000	17,692,000
	Barrels	
Arabian American Oil Co. ...	42,371,570	175,865,191
Bahrain Petroleum Co. Ltd ...	1,351,165	5,407,405
Getty Oil Co. and American Independent Oil Co. (Kuwait–Saudi Arabia Neutral Zone)...	4,529,269	18,032,882

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for April was 617,000 tons, the total for 1 January to 30 April being 3,801,000 tons.

Crude processed at Aramco's Ras Tanura refinery during April was 7,837,106 brl, the total for 1 January to 30 April being 30,192,318 brl.

Kuwait Oil Co. Ltd's average production for the first four months of 1961 was 1,704,982 bd.

Lectures, Courses, and Conferences

Courses for Welding Technologists

Among the courses listed in the latest prospectus of the School of Welding Technology are those entitled "Welded Pressure Vessels" which will be held from 2–6 October, 1961; "Residual Stresses and Stress Relief" being held on 16–17 October, and "Practical Control of Distortion" due to take place from 18–20 October.

Copies of the prospectus are available from the School at 54 Princes Gate, London, S.W.7.

Physics of Graphite Moderated Reactors

The Institute of Physics and The Physical Society and the British Nuclear Energy Conference is sponsoring a symposium on "The physics of graphite-moderated reactors" in Bournemouth from 4 to 6 April 1962. The symposium is intended particularly for the less senior members of research and development staffs. Contributions are invited for consideration by the committee. Details are available from the secretary of the Institute and Society at 47 Belgrave Square, London, S.W.1.

A typical scene in the conference room—rarely were there many empty seats

The Brighton Symposium

Need for Co-operation in Lubricant Testing

From any point of view the Symposium on Engine Testing of Crankcase Lubricating Oils organized by the Engine Tests of Lubricants Panel of the Institute of Petroleum and held in Brighton 17–19 May 1961, must be accounted an unqualified success. Originally visualized as a comparatively small gathering of not more than about 100 persons it finally attracted a total of about 380, with delegates from some twenty countries as far afield as Australia.

The thirty-three papers in the Symposium were arranged in six main sessions, as follows:

Session A. Activities of IP panels.
Session B. Contributions from national organizations other than the IP.
Session C. Contributions by individual laboratories.
Session D. Contributions by military authorities.
Session E. Contributions from diesel engine manufacturers and users.
Session F. Contributions from car manufacturers.

The Symposium was very well supported by papers from both U.S. and European delegates. In all ten papers were presented by U.S. authors, including contributions from representatives of the Co-ordinating Research Council, the American Society for Testing Materials, the U.S. Navy, the U.S. Army Ordnance, and motor manufacturers. Similarly corresponding bodies in Europe provided papers which added to the success of the Symposium. Nine papers were presented by European authors representing the Institut Français du Pétrole, the French Navy, the Ausschuss Motorische Prüfmethoden (Germany), Commissione Tecnica de Unificazione nell autoveicolo (Italy), the Hungarian Oil and Gas Institute, the European Council for the Standardization of Test Methods in the Petter AV.1 Engine, and a Swiss diesel manufacturer. Of the fourteen papers from the United Kingdom, four were presented on behalf of the Institute of Petroleum and the others included contributions from a British motor manufacturer, a diesel engine builder, BICERA, the Admiralty Oil Laboratory, the War Office, and individual laboratories in the U.K.

The object of the meeting was to discuss developments which had taken place during the past eight years in all parts of the world in the field of engine evaluation of crankcase oils. It was also particularly desirable that co-operation between the petroleum industry and the motor industry be improved and that some method be developed of achieving better co-ordination of the total efforts of the two industries on subjects of common interest.

A reproduction of the colour slide which was used to illustrate collaboration of the petroleum and automotive industries in the U.S.A.

Such was the attraction of the subject that even brilliant sunshine and the counter-attractions of a seaside resort failed to reduce materially the attendance at any of the sessions. In the 2½ days of the conference the total session time was 17½ hours, and on one day of 9½ hours 7½ were spent in the conference room.

Some of those who took part in the late-night session of the European Council. (Left to right) J. G. Withers (British Petroleum Company Ltd); Prof M. Brunner (Federal Institute for Testing Materials, Switzerland); W. H. Thomas (chairman, IP Standardization Committee); J. Thiery (Institut Français du Pétrole); Dr Norman Kendall ("Shell" Research Ltd); J. C. Cree (British Petroleum Company Ltd); Prof E. Sibenaler (Ecole Royale Militaire, Belgium); A. Towle (Lubrizol Great Britain Ltd); F. F. van Quaethoven (Petrofina S.A. Belgium); Dr A. Mora (Institute Nacional de Technica Aeronautica, Spain); Dr F. Mina (Aquila SpA, Italy); Dr H. E. Kruppke (Daimler-Benz AG, Germany)

ending with a $2\frac{3}{4}$-hour continuous sitting to wind-up the day.

Chairman of the meeting was Dr Norman Kendall, who is chairman of the Engine Tests of Lubricants Panel. In his opening address he said that the Panel was formed about fifteen years ago and in 1953 organized the first symposium in order to review its programme of test development and to formulate a policy along which its future activities would be directed. The points brought forward in that discussion had been considered in detail by the Panel in planning its work which had culminated in the recent publication of Part III of "IP Standards".

During the past eight years the members of the Panel had gained much experience, said Dr Kendall. Consequently, at the beginning of 1960 it was decided to hold the present Symposium in order (1) to report on the work which had been done during the period since the first Symposium; (2) to obtain a critical appraisal of that work; (3) to hear what others working in the same field were doing and thinking; and (4) to replenish and bring up-to-date the pool of knowledge on the subject.

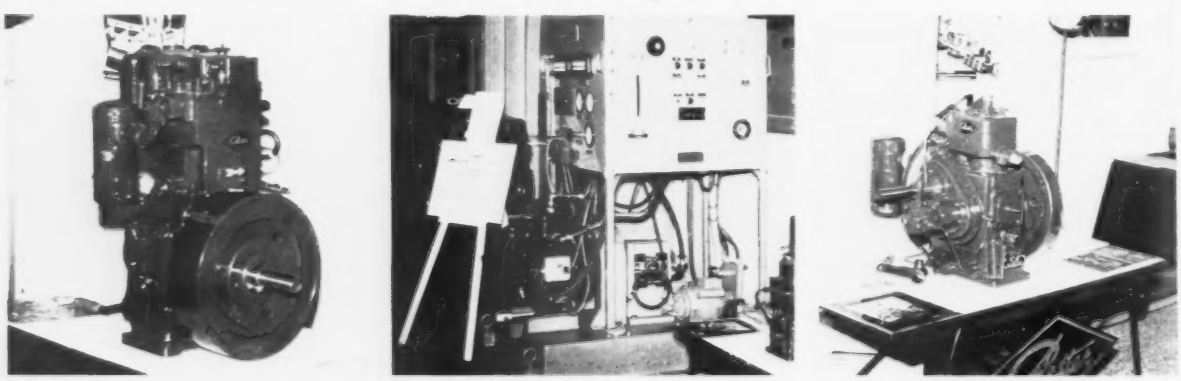
In his concluding address, Dr Kendall said that he felt that the four main objectives of the Symposium had been realized. It was not possible in the time available to have digested, or even to have summarized, all the knowledge which had been presented during the Symposium. However, he felt that the meeting had shown in no uncertain manner that there was a desire from individuals and from organizations for, first, closer co-operation and collaboration between the petroleum industry and the motor manufacturers in the United Kingdom; secondly, a similar stage in other countries individually; and, thirdly, international agreement on a world-wide basis.

Success, said Dr Kendall, would be judged not on what had been said but on what would be done. He thought that they all should concentrate on the ways and means of securing the desired co-operation and collaboration for the benefit and common interest of all.

Petroleum–Motor Industries Co-operation Needed

Throughout the discussions there was frequent reference to the urgent and vital need for greater co-operation between the motor and petroleum industries in the U.K. and in Europe, in order that full advantage be taken of the benefits afforded to the motor industry by developments in lubricants and, for that matter, fuels as well. Conversely, the petroleum industry needed to have advance information in general terms of the trends in new designs of internal combustion

The exhibition, which attracted considerable attention, included the two Petter test engines, the AV.1 (left) and the W.1 (right), with the Heenan & Froude test assembly in the centre



At the Brighton Symposium

The main recreation at the Brighton Symposium was the cocktail party given by Shell-Mex and B.P. Ltd, where most of the above pictures were taken. Even during this event there were still many who were discussing the work of the day. Guests were received by W. S. Ault (left in top centre picture) and many notable figures in the field of engine evaluation of oils will be seen. At coffee time (limited to 15 minutes) some were lucky enough to get a chair (bottom right) and in the far too short lunch interval a few got out for a breath of fresh air (bottom left)

A few of those who gave up their time to attend the joint CRC and IP/CLR meeting. Standing (left to right) E. J. McLaughlin (California Chemicals Company); L. A. McReynolds (Phillips Petroleum Company); E. A. Martin (Socony Mobil Oil Company); P. Newman (British Petroleum Company Ltd); Dr R. B. Whyte (National Research Council of Canada); M. K. McLeod (CRC); P. A. Bennett (General Motors Corporation); J. C. Cree (British Petroleum Co. Ltd); J. Thiery (Institut Français du Pétrole); seated E. P. Zammett (British Petroleum Company Ltd); G. E. Serjent (IFVME War Office); L. W. Chambers ("Shell" Research Ltd); R. Pearson (IFVME War Office); J. W. Todd (Lubrizol Great Britain Ltd); E. J. Lambert (Mobil Oil Company Ltd); Prof E. Sibenaler (ERM, Belgium); S. J. Crampton (Esso Research Ltd)

engines and transmissions in order to be ready with new lubricants of suitable characteristics.

It was pointed out by more than one speaker that, apart from one major manufacturer, the British motor industry was poorly represented at the Symposium. It can be said here that prior to the Symposium the Organizing Committee had, collectively and individually, made great efforts to induce the motor manufacturers, both directly and through the Motor Industry Research Association, to contribute papers discussing their requirements in the field of lubricant testing. Similar efforts had also been made to induce users of engine lubricants to contribute papers but without success. Not one paper had been offered by any user in any country.

In presenting his paper on "General engine oil evaluation philosophy", L. A. McReynolds of the CRC used a slide which showed how in the United States the petroleum and automative industries collaborated for the benefit of "John Q. Public". That illustration is reproduced here. From one speaker it drew the comment that he was glad to see that the petroleum industry was in front, while another observed that the petroleum industry was being pushed from behind by the automotive industry.

Exhibition

In connexion with the Symposium there was a small exhibition limited to the Petter AV.1 and W.1 engines included in the IP standard methods. There was also a complete, compact, and fully-instrumented test installation by Heenan and Froude Ltd which would take either of the Petter engines. These exhibits attracted much attention.

Conference Dinner

An official conference dinner was held on the Thursday evening, presided over by Julian M. Leonard, president of the Institute. In a commendably short speech he welcomed the delegates and expressed the hope that they would benefit greatly from their deliberations.

M. K. McLeod, manager of the Co-ordinating Research Council, expressed the thanks of all the delegates to the Panel and to the Institute for organizing the meeting. He was convinced that some means had to be found to get the petroleum and motor industries together. The problems which faced them were not national but international. They varied in detail but were fundamental in the need to match lubricants and fuels in the engines in which they were used. All were working for the same purpose and that was to satisfy the motorist on the road.

Except for a small number at the top table and a collective grouping of the authors, seating at the dinner had been organized on the basis of a good and complete mixture. Consequently, no delegate found himself next to a colleague from his own company and there were many who made favourable comments on this arrangement.

International Meetings

Not content with long sessions alone, advantage was taken of the presence of overseas delegates to organize joint meetings on an international basis.

Thus, at 6.30 on the Thursday, representatives of the CRC and of the IP/CLR Sub-panel of the Engine Tests of Lubricants Panel held an informal meeting to discuss the present state of the CRC–L38 procedure with respect of reproducibility of bearing weight loss results. These deliberations concluded at about 8 pm but, shortly after 10 pm, some of the same delegates were at a meeting of the European Council for the Standardization of Tests in the Petter AV.1 Engine. This one remained in session until after midnight.

Entertainment

"All work and no play makes Jack a dull boy" is an old adage. Thanks to various oil and additive supply companies, who threw open their private suites to the delegates after the day's work, there was some scope for entertainment and relaxation. But observation showed that, even around the cocktail bar or in a comfortable chair, discussion on the merits of this or that test continued apace.

Prior to the conference dinner, all delegates were guests at a cocktail party given by the directors of Shell-Mex and B.P. Ltd. They were received by W. S. Ault.

The Proceedings

It is the intention of the Institute of Petroleum to publish the full report of the proceedings, including all papers and discussions, as soon as possible. Details of this publication will be made available in due course.

Personal Notes

C. M. Vignoles

J. E. H. Davies

C. M. Vignoles, C.B.E., M.A., M. Inst. Pet., managing director of Shell-Mex and B.P. Ltd, retired at the end of June when he was succeeded by **J. E. H. Davies.** M.B.E., F.C.A., M. Inst. Pet.

Mr Davies joined Anglo-Iranian Oil Company in 1946 and was for two years in Stockholm with Svenska BP. Later he became area manager in Western Markets Division and, in 1951, assistant general manager, Western Areas. In 1953 he was assigned to Paris as nominated director of the French associated company of the BP group. In 1956 he was appointed general manager, Western Markets Division, and general manager, Markets Department, in 1957.

Mr Davies was educated at Windlesham House School, Sussex, and St Edward's School, Oxford. He qualified as an Associate of the Institute of Chartered Accountants in 1939 and was elected a Fellow in 1960.

Mr Vignoles had been managing director since 1951, and his retirement came after 37 years in the oil industry which began in 1924 when he joined the Asiatic Petroleum Company in Malaya. He stayed there for eight years, returning to London in 1932 and worked in the Fuel Oil Department of the Shell Petroleum Co. until 1940 when he became the Company's representative on the Overseas Supply Committee of the Petroleum Board. Later Mr Vignoles became joint executive secretary of the Committee and was vitally concerned with organization of the nation's wartime oil supplies. He was awarded the O.B.E. in 1946.

Between 1946 and 1950 he was eastern area manager of the Shell Group. At the end of 1950 he was elected to the Board of Shell-Mex and B.P. Ltd and in March 1951 became managing director.

At the time of the Suez Canal crisis in 1956 he became chairman of the Oil Industry Emergency Committee. He was awarded the C.B.E. in 1957. He served as President of the Institute of Petroleum in 1958/1960, and is a member of the Council of the Institute of Directors.

Lord Rothschild, a director of "Shell" Research Ltd since 1959, has been appointed vice-chairman of the Board. He will continue as a scientific adviser to the Company and will become its principal representative in matters relating to academic, government, and private research in Britain when the present general manager, **Dr C. G. Williams,** F.Inst.Pet., retires in October.

Lord Rothschild is an assistant director of research in the Department of Zoology, Cambridge University, and he will continue with his work there in the field of biophysics. He was formerly a Research Fellow of Trinity College, Cambridge, and is a Ph.D. (Cambridge), and Sc.D. (Cambridge), and a Fellow of the Royal Society.

The particular interests of Castrol Ltd's four new assistant managing directors whose appointments, which will take effect from 1 January 1962, were announced in the May *IP Review*, have now been defined and will be as follows.

J. A. V. Watson will be responsible for industrial trading in the United Kingdom; research; technical development; aviation; and the Motor Manufacturers Department.

L. G. Packham's special interests will cover overseas operations involving Castrol trading; industrial trading; purchasing; and production.

C. E. R. Millidge will deal with Castrol Trading in the United Kingdom, and the Group's Engineering Division.

A. A. Barr will be concerned with publicity; competitions; purchasing and production in the U.K.; and projects and developments.

Dr Neil V. Hakala has been named deputy to the vice-president for petroleum products, medical, basic and analytical research, of the Esso Research and Engineering Company. Dr Hakala was previously director of the Products Research Division, and **Robert L. Weeks,** formerly an assistant director, has been named acting director of that division. He succeeds **Dr John G. McNab** who was recently made chairman of Jersey Standard's "New Uses Committee."

Dr Hakala, who joined Esso Research in 1943, has been director of Products Research since 1957. He has served as a consultant on lubricating oil processing matters at refineries in France and England, and has also been assistant director of the Company's Process Research Division.

J. B. Bryce

R. O. Keyworth

J. B. Bryce who has been Mobil Oil Company's chief engineer (Marine Trade Department) since 1954 has become technical adviser to the Marine Sales and International Accounts Department of Socony Mobil Oil Company Inc. Mr Bryce joined Mobil in 1946 as sales engineer for Belfast and Dublin and remained there until 1948 when he became marine branch manager at Liverpool.

R. O. Keyworth, who had been marine branch manager at Liverpool since 1954, has succeeded Mr Bryce as chief engineer (Marine Trade Department). He joined Mobil in 1952 as a Sales (Marine) Engineer attached to the City Marine Office.

R. B. Stokke, treasurer of Esso Export Corporation, has been elected to the board of directors. He replaces **E. G. Lindroth,** who has resigned as a director and senior vice-president to join Jersey Standard, and will continue to be concerned with the financial aspects of the Corporation.

Mr Stokke attended Duke University, New York University, and Harvard University's Graduate School of Business Administration, and joined Standard Jersey's treasurer's department in 1937. In 1944 he transferred to Esso Export and three years later was appointed assistant treasurer of the Corporation, being elected treasurer in 1954. In 1958 he became Jersey Standard's regional marketing co-ordinator for Latin America, and returned to Esso Export the next year when he was again elected treasurer.

P. S. Linklater has been appointed general manager of Shell Chemical Company's newly formed Administration and Services Division. A barrister who read natural sciences at Cambridge, Mr Linklater joined the Royal Dutch Shell Group in 1954 as a member of Licensing and Agreements Department of the former Chemical Industry Administration of Shell Petroleum Company. On the formation of Shell International Chemical Company in 1959, he was appointed head of the Chemical Licensing Division, the post he held prior to taking up his new appointment.

Colonel **F. T. Davies** has become senior vice president of the Gulf European Company, which he joined in 1956 as vice president and co-ordinator. He is a director of Gulf Oil (Great Britain) Ltd, and president of the International Committee on Man-Made Fibres.

D. L. Samuel, B.Sc.(Hon.Chem.), A.R.I.C., F.Inst.Pet., who is an IP Member of Council and was formerly technical adviser and writer on oil products to Shell International Petroleum Co., has been appointed the head of the petroleum industry and chemical engineering section of the new Technical Writing Division of Pergamon Press.

We note with regret the death of **Henry E. Bedford,** who was formerly an executive with Standard Oil Co. (New Jersey). He had been based on London since 1932, continuing to live there after his retirement in 1951. He died while visiting relatives in Baltimore.

Brian Pavey, B.Sc., A.M.Brit.I.R.E., has been appointed technical manager of Burtonwood Engineering Co. After a period spent in India instructing on radar and electronics, Mr Pavey became a technical assistant with Electro-Hydraulics Ltd and attended the Royal Technical College, Salford, taking a London University external degree. He later became a lecturer on electronic engineering in California. Prior to taking up his new appointment Mr Pavey spent 10 months with Burtonwood Engineering's American parent company, U.S. Industries Inc.

Iain Smith

Iain Smith, B.Sc., A.M.I.E.E., has been appointed a director of M. & C. Switchgear Ltd. His previous appointments within the Company have included chief of Engineering Department and technical manager.

R. T. Miller

A. George

R. T. Miller has been appointed managing director, and **A. George** has been appointed assistant managing director of Fletcher Miller Ltd, a member of the Castrol Group of Companies. Mr Miller served in various departments within the Company before being appointed a technical representative in 1938. Following war service, he became actively engaged in the general management of the Company and was appointed to the Board in 1953.

Mr George joined Fletcher Miller Ltd, as secretary in 1948 and was appointed to the Board in 1953. He had previously served as company secretary to S. Clayton & Co. and later to Aerialite Ltd.

W. R. Owen has been given responsibility for Cardiff and Manchester branches of Honeywell Controls Ltd, in addition to continuing as Birmingham branch manager. This follows the transfer of **T. Jackman** and **R. Robson** to head office positions at Greenford, Middlesex, where they will be field sales manager and market sales manager respectively.

L. Grunberg, D.Sc., M.Sc., F.R.I.C., A.M.I.Chem.E., F.Inst.Pet., has been appointed superintendent of fluids group of the National Engineering Laboratory with the rank of deputy chief scientific officer.

Glenn Herz has been elected vice-president - engineering of the Hyster Company of Portland, Oregon, U.S.A., and **James L. Woodley** has been elected vice-president - manufacturing of the same company.

D. Kenneth Finlayson has been elected vice-president - sales of Scientific Design Co. Inc. He was previously Eastern representative of the Business Development Group and a vice-president of Bechtel International Corporation.

C. E. Wrangham has retired from the Boards of Davy-Ashmore Ltd and its subsidiaries.

PANEL SECRETARY RETIRES

At a recent meeting of the Hydrocarbon Analysis Panel held at the BP Research Centre, Sunbury-on-Thames, the members presented H. C. Rampton with a small table lighter on his retirement from the panel after 17 years service as Member and Secretary.

The Chairman thanked Mr Rampton for his guidance and the benefit of his experience, unstintingly given, over many years.

Notes of the Month

BP Starts Survey Work in Western Greece

Under a concession which only took effect at the beginning of May, BP has already started geological survey work in Western Greece.

The area concerned covers some 2000 sq miles in the Aetolia-Akarnania Province and the islands of Lefkas and Cephalonia. The BP Exploration Company (Greece) Ltd, which is conducting the oil search operations, hopes to drill the first test well there in 1962.

The concession is held by the Aetolian Oil Co. SA which is jointly owned by BP and the National Bank of Greece.

Decline of Profitable Wildcat Discoveries in U.S.

The American Association of Petroleum Geologists reported recently that in 17 leading oil and gas producing States wildcat discoveries that could be considered profitable made up less than 2 per cent of all wildcats drilled in new fields.

The report classifies a profitable wildcat as one which taps a minimum of 1 million barrels of oil reserve.

The report was based on a study of fields in which discovery wells were completed during the period 1944–54. With two minor exceptions, the report shows that the percentage of discoveries yielding 1 million or more barrels of oil reserves has been declining regularly. In 1944 the number of unprofitable holes drilled for each profitable oil discovery was 35 : 1 as compared with 59 : 1 in 1954. The average for the 11-year period was 44 : 1.

During this same period, discovery wells, irrespective of the extent of reserves, maintained their customary level of one in nine.

Middle East Oil Production

Total oil production in the Middle East in the first quarter of 1961, amounted to just over 70 million metric tons, according to figures just released by the Petroleum Information Bureau. This was almost identical to the yield obtained during the final quarter of 1960, but was 10·7 per cent higher than Middle East production in January–March of the same year.

The leading countries all showed substantially higher outputs as compared with a year ago. Kuwait yielded 20,932,000 tons, Saudi Arabia produced 17,799,000 tons, Persia supplied 13,770,000 tons, and Iraq had an output of 11,951,000 tons. Chief among the other producing areas was Qatar, which yielded 2,071,000 tons, and the Kuwait/Saudi Arabia Neutral Zone which had an output of 1,971,000 tons.

Comparative details of Middle East production in the first quarters of 1960 and 1961 are given in the following table.

	1960 (*Jan.-March*) *Metric tons*	1961 (*Jan.-March*) *Metric tons*
Kuwait	19,372,224	20,931,976
Saudi Arabia	14,706,975	17,799,150
Persia	12,580,168	13,769,664
Iraq	11,253,937	11,950,732
Qatar	2,140,355	2,070,512
Kuwait S.A. N.Z.	1,678,887	1,971,292
Others	1,580,846	1,577,497
Total	63,313,392	70,070,823

The Hon. M. R. Bridgeman, chairman of BP, visited West Africa recently to inspect oil search operations in Senegal. He is seen here meeting the Prince Consort of the Floups tribe. BP has a 50 per cent interest in Société des Pétroles du Sénégal, whose manager, M. Guilhaudis, is in the centre of the picture. The Company holds an exploration permit covering 40,488 sq km in the Republic. Extensive geological and seismic surveys have been carried out in the area and 18 test wells have been drilled

Spanish Refinery for Libyan Crude

The Spanish Government has approved the proposal of Ohio Oil Company and its Spanish associates to build a refinery in northern Spain. The 25,000 bd installation, which it is expected will be sited on the north Atlantic coast, is scheduled to be completed within 36 months at a cost of about £18 million.

Ohio Oil will supply the refinery with crude oil from its substantial oil reserves discovered in Libya.

Eighty-four per cent of the total cost of the refinery will be borne by Ohio, and a group of Spanish business associates will provide the remaining 16 per cent of the capital.

In return for Spanish permission to build the refinery, Ohio Oil and Spanish associates agreed to transfer 52 per cent ownership in the refinery to the Spanish Government. Four per cent will be held by Compania Iberica de Petroleos SA, a holding company which is partly-owned and managed by the Fierro family, a prominent Spanish banking and industrial group. Ohio Oil will retain 28 per cent ownership in the refinery and its Spanish associates will hold 16 per cent.

The oil company will provide all the crude oil requirements of the refinery for the first 10 years, or 10 million tons of crude oil, whichever occurs first. During the second 10-year period, Ohio Oil will supply part of the crude oil requirements of the refinery on a preferential basis. Spanish labour, where technically qualified, will be employed in building and operating the refinery, and, where feasible, Spanish materials, equipment, and supplies will be utilized.

Included in the refinery project will be a marine terminal for large-size tankers, and storage facilities for over 2 million barrels of crude oil and refined products. It is anticipated that the principal output of the refinery will be fuel oil, but that it will also manufacture kerosine, diesel oil, premium and regular grades of gasoline, heavy naphtha, propane, and butane.

Spain has two refineries with a total capacity of 140,000 bd. The largest is an 80,000-bd unit located near Cartagena, which is government-controlled and operated. The second, privately owned, has 60,000-bd capacity in Tenerife in the Canary Islands, a Spanish possession.

In Libya, Ohio Oil has one-third interest in large oil and gas reserves that have been developed in the Dahra field, Concession 32. Initial production tests of the oil wells have ranged from a few hundred to 11,500 bd. Significant discoveries also have been made in other Libyan concessions, but the Dahra field is the most developed. Ohio Oil and two associates own over 53 million acres of Libyan concessions.

Work has begun on the 300,000 bd Sidrah pipeline which will carry crude oil from the Dahra field to the Gulf of Sirte on the Mediterranean. Ohio Oil will have a substantial interest in this pipeline and its marine terminal being built by Oasis Oil Company of Libya Inc., on behalf of six oil companies. Oasis is the operating company jointly held by Ohio Oil and two associates.

It is planned that Spanish tankers will transport the Libyan crude oil from Es Sider on the Gulf of Sirte to the marine terminal of the new refinery.

Latest News of Pakistan Oil Search

A gravity survey covering 5000 sq miles in six of Pakistan Petroleum Ltd's most recently granted exploration licence areas has just been completed, only nine months after the work started.

The areas surveyed were the Karachi Plain, Kundian, Tank, Tank Extension, Sanghar, and Khairpar Extension. In all, 5600 gravity stations were measured, mostly over alluvial areas, but there was some hilly country in the Tank and Tank Extension regions.

Other exploration news from Pakistan is that Attock Oil Co's Dhulian No 41 has been plugged back from 9300 ft to 8962 ft and is now on test, Pakistan Oilfield's Tanwin No 1 is drilling below 7418 ft and Dhulian No 2 has reached 3203 ft, while the joint venture by Pakistan Petroleum–Pakistan Sun at Dasori Test Well No 1 has been abandoned.

New Depth Record

Also from Pakistan comes details of the deepest well ever drilled in the Indo-Pakistan sub-continent. This is Pakistan Shell's Rasidpur-2 in East Pakistan's Sylhet district some 200 miles north of Chittagong, which has reached 15,033 ft.

Rasidpur-1 discovered natural gas last November at 12,600 ft, the first positive result of nearly five years search by the Company in both East and West Pakistan. The second well is being drilled to the greater depth in the hope of finding oil.

Trinidad Petroleum Development Co. in 1960

During 1960 improved drilling techniques enabled Trinidad Petroleum Development Co. Ltd, to drill a record footage which in turn resulted in an increase in the number of wells completed. This was one of the factors responsible for a modest increase in production to 6,295,697 barrels for the year.

On land the results of exploratory and appraisal drilling in 1960 were reasonably satisfactory, especially at Moruga. However, proved areas are being drilled at a rate somewhat faster than new areas are being established, and it is probable that present production from the Company's land acreage will prove to be at its peak.

In the Gulf of Paria, a test well NM-2 was brought in at the relatively high rate of 1000 bd, but showed a rapid decline so that it is still uncertain whether the reservoir being tested will prove a commercial producer.

It is hoped that three wells will be drilled in the same area during 1961 and a further well off the South Coast. A drilling barge will be used for this work which is expected to involve expenditure of about £375,000 by the Company this year.

To Study the Earth's Crust

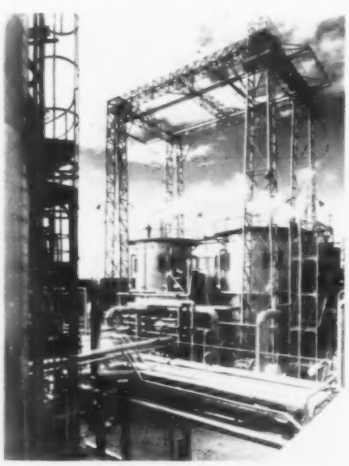
An Earth Sciences Observatory is now being built near Leonard, Oklahoma, about 20 miles south-east of Tulsa, for the Jersey Production Research Company. When completed it will represent an investment of more than $100,000.

Part of the research work to be conducted at the site will include the drilling of several instrument holes to depths of 2000–3000 ft, for the purpose of making simultaneous measurement of naturally occurring events in the earth's crust. The installation will include a sub-surface vault in which delicate instruments will be mounted on a concrete pier set in bedrock located about 17 ft below the surface of the earth. This will not only aid in shielding the instruments from unwanted disturbances but will also permit close temperature control.

The Observatory is expected to be completed and in operation by the latter part of this summer.

Highest-ever Gas Reformer Operating Pressure

What is believed to be a major breakthrough in gas reforming has been achieved by a new high-pressure gas reform furnace installed at an ammonia plant in Southern France. It has an operating pressure of 250 psig, which is substantially above the previous highest operating pressure of 175 psig achieved by earlier gas reformers.



A view of the high pressure, gas reforming furnaces in Southern France

By reforming natural gas at such a high pressure, the designers, Chemical Construction Corporation, have been able to eliminate one of the numerous compression stages normally required in a plant of this type.

Another advantage claimed for the new reformer is that it gives improved heat recovery in the combined reform and CO_2 removal system, allowing heat to be exported to the rest of the plant.

Particle Accelerator Speeds Petroleum Analysis

Methods of analysing chemicals in "a routine 10 minutes" instead of the hours and sometimes days taken by conventional chemical methods have been developed by Shell

A Shell scientist operating the deuteron accelerator

Research scientists at their Emeryville, California, laboratories, where they have been in use for the past two years. By using the radiation method, called activation analysis, they have developed instrumental procedures for spotting 26 of the elements which appear most frequently in petroleum, and recently a new type of particle accelerator has made it possible to detect at least nine more elements.

It is a deuteron accelerator which fires deuterons, the positively charged nuclei of heavy hydrogen, at speeds of 8½ million miles/hour at a target of extra heavy hydrogen or tritium. Under this bombardment, the tritium emits high energy elementary particles known as neutrons, which in turn are used to bombard the samples under study, making them radioactive.

In returning to their normal states these nuclei give off gamma rays, which differ for each type of atom. Detection equipment, usually a scintillation counter hooked to a gamma ray spectrometer, is then used to identify each element present by the rays emitted.

The method makes it possible to pick out minute quantities of some elements. It will, for example, detect a single part of vanadium in 10 million parts of oil. The radioactivity produced in the samples rapidly disappears, so that they can be used safely in other tests after the analysis.

Sale of Honolulu Oil Corporation

Agreements relating to the sale of Honolulu Oil Corporation provide for Pan American Petroleum Corporation to acquire the working interests of Honolulu in substantially all of the oil and gas properties of Honolulu in the Mid-Continent, Northern Rocky Mountain, and Canadian areas, subject to an excepted and retained production payment on certain properties and an undivided one-half interest in Honolulu's Alaskan properties. A further agreement between Honolulu and a group of seven corporations provides for the purchase of the excepted and retained production payment.

The working interests of Honolulu in most of its oil and gas properties in California will be acquired by the Tidewater Oil Company. This agreement is also subject to an excepted and retained production payment on certain of the properties and an undivided one-half interest in Honolulu's Alaskan properties which will be purchased by another group of four corporations.

The agreements are all interdependent and will take effect simultaneously. But first they must be approved by Honolulu stockholders at a meeting in San Francisco later this month.

Honolulu owns 1095 net oil and gas producing wells in West Texas, New Mexico, Wyoming, and Canada, and a further 555 net oil and gas producing wells in California. Its gross average daily production is currently about 52,000 barrels of oil and 3200 barrels of natural gas liquids, with a gross natural gas production of approximately 78 million cu ft/day.

Shell's First Time at Achema Exhibition

The Royal Dutch Shell Group stand at the Achema Exhibition held in Frankfurt from 9–17 June was the first occasion on which the Group had been represented at this Exhibition.

Its stand showed various aspects of research, process development, manufacturing operations, and product and applicational development in petrochemicals technology. It included demonstrations of the two-phase flow research apparatus, a means of investigating the behaviour of the simultaneous flow of gases and liquids through horizontal tubes; the rotating disc contractor, developed by the Group's technologists as a tool for the separation and purification of liquid mixtures; and the Shell gasification process, for the gasification of any type of liquid hydrocarbons.

Domestic Heating Exhibition on Tour

A mobile exhibition which includes exhibits designed to propagate the advantages of oil-fired domestic heating is now touring Britain. Mounted behind an 8-ton tractor unit, it will have visited nearly 40 county shows, trade fairs, and other functions by the end of October.

It is sponsored by the fuel distributing firm of Charringtons. The oil-fired boilers on show include both the pressure-jet type and the vaporizing type. For the benefit of the thousands of people who are expected to visit the exhibition, they will be shown under fire heating water for a facsimile kitchen and a radiator.

This is the first exhibition of its type ever organized by the firm, and it involved many months of planning. The exhibits are ingeniously arranged in a 28-ft long trailer which, as well as the kitchen, also includes a boiler house setting.

A selection of solid fuel boilers is also included in the exhibition to enable visitors to judge the relative merits of the two forms of domestic heating.

BP's Largest Tanker Laid Down

The keel of BP Tanker Co.'s largest ever tanker has been laid down at the John Brown and Co. yard on Clydebank. She will be approximately 67,500-dw tons with a length of 815 ft and a width of 112 ft.

The new tanker, the first of seven similar ones on order for the Company, is expected to be launched early in 1963.

Australian Boom in Oil Burning Equipment

Demand for oil burning equipment in Australia has risen by 52 per cent in two years. More than 3400 oil burner units were sold to industrial, domestic, and commercial users there last year.

According to the Petroleum Information Bureau of Australia, domestic units showed the largest increase with a rise of 71 per cent in two years.

1960 Road Safety Award

Peter G. Cross, a British Railways signalman, has been awarded the National Trophy as the individual judged to have made the greatest contribution by personal effort towards the safety of children on the roads during 1960.

The Trophy is donated annually by Shell-Mex and B.P. Ltd and it was presented to Mr Cross by the Minister of Transport at a recent luncheon at Grosvenor House.

Watched by his daughter and C. M. Vignoles, Peter G. Cross receives the National Trophy from the Minister of Transport

Sixteen men and women with the single aim of saving children's lives on the roads, came to London to be interviewed by judges appointed by the Ministry of Transport in consultation with the Royal Society for the Prevention of Accidents. All of them were nominated by local authorities.

The National Trophy is fashioned in crystal glass, 21 inches high, upon which is engraved a boy and a girl shielded by a pair of cupped hands to signify that "Their lives are in your hands."

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Petroleum in Parliament

Domestic Kerosine Tax

The Chancellor of the Exchequer told a questioner on 2 May that just over 1 million tons of domestic kerosine were sold between 5 April 1960 and 5 April 1961. He said the tax on domestic kerosine was expected to raise about £3 million during the present financial year.

Multi-Purpose Pipelines

On 16 May, the Parliamentary Secretary for Science told a questioner that neither his Department nor the Department of Scientific and Industrial Research had sponsored any research into multi-purpose pipelines. Asked whether research into this subject would not be of value to the Minister of Power and MP's when considering future legislation, he said that the D.S.I.R. was doing a great deal of research into the problem of transporting various sorts of liquids and solids by pipelines, and while it had not been possible to include multi-purpose pipelines in the research programme, the Department was willing to discuss the matter with industry.

Imports from Eastern Europe

The Minister of State to the Board of Trade said on 2 May that the countries from which oil imports need to be specially licensed are: Albania, Bulgaria, Czechoslovakia, Germany (Soviet Zone), Hungary, North Korea, North Vietnam, People's Republic of China, Poland, Rumania, and the U.S.S.R. He said the only imports from these countries during the last five years were fuel and lubricating oils. Details of these are given in the following table.

UNITED KINGDOM OIL IMPORTS FROM COMMUNIST COUNTRIES

	1956		1957		1958		1959		1960	
	Gallons	*£*	*Gallons*	*£*	*Gallons*	*£*	*Gallons*	*£*	*Gallons*	*£*
Fuel oil:										
Soviet Union	—	—	15,293,482	593,560	—	—	12,786,581	299,786	36,541,582	712,631
Germany (Soviet Zone) ...	—	—	—	—	14,151	2,879	—	—	—	—
Poland	—	—	—	—	4,097	645	—	—	—	—
Lubricating oil:										
Soviet Union	3,817,896	252,144	6,924,532	559,845	7,875,626	575,796	7,375,403	553,417	7,868,274	623,772
Germany (Soviet Zone) ...	—	—	—	—	121,886	9,960	130,170	10,338	—	—
Poland	—	—	206	46	—	—	100,376	9,655	1,497	652
Czechoslovakia	39	31	—	—	1	2	2,199,289	183,157	3,084,336	272,077

N.B.—There are no recorded imports from Eastern Area countries other than those shown.

British Petroleum Company's 1960 Operations

A few home truths on the system of "50/50" profit sharing agreements were given by the chairman of The British Petroleum Company Ltd when he referred to the Company's results for the year in his statement to stockholders contained in the 1960 *Annual Report and Accounts*. The following are some of the comments made by Mr Bridgeman on the subject.

"The statement that we pay a fair rent to the landlord is often challenged, for there is still a widespread belief that, in spite of the "50/50" agreements for sharing the profit arising from the production operation, the oil companies are depriving the producing countries of a fair share of the profits.

"The main increase in world production in 1960 took place in the Middle East where the increase was over 33 million tons. Payments to the Middle Eastern countries under the "50/50" agreements are based on posted prices, and the total sum included in our 1960 accounts for such payments was £128 million. This figure is substantially greater than that for 1959 despite the slight reduction last August in the posted prices of crude oil at producing centres in the Middle East. The explanation is, of course, that a greater volume of oil was lifted, and this more than counteracted the effects of lower posted prices.

"Our own Group profits, which last year amounted to just over £62 million, are related to the price we realise for the oil when we sell it; and, to the extent that such sales are in the form of refined products, these profits represent the result of all the operations involved, and not merely those related to production.

"It is not possible for us to bring the consumer the ever greater quantities of oil which are required unless we provide not only the production facilities in the producing areas, but also the tankers, pipelines, refineries, and marketing installations which are necessary. But although the increase in revenues of the producing countries depends on the availability of all these facilities on a steadily mounting scale, the Governments concerned are not obliged to spend on the provision of such facilities any of the money they receive from oil royalties and taxes, and they are, therefore, free to direct their revenues towards those projects which are vital to their economic development, but for which private capital is not so readily available.

"Capital expenditure of the Group in 1960 was £112 million. Although this was a drop of £29 million on that spent in the previous year, it was expected that the figure would rise again in 1961.

"The extent to which the industry must at present rely on the world's capital markets for its further expansion makes it essential that we should try to maintain reasonable and reasonably stable price levels. For if prices fall, the proportion of the sum that the industry must obtain from the world's money markets to finance its expansion will increase. It is consequently a cause for concern that, in attempting to maintain these price levels, companies such as our own, which operate on commercial principles, should have to meet severe competition from those which can rely on preferential positions and financial support from their governments. Such competition has now to be faced not only from behind the Iron Curtain, but also from other directions. Hence the need for us to keep down our own costs and to obtain the maximum benefit from technical development, both of which objectives are in the forefront of our minds.

"The maintenance of a reasonable stability of prices is rendered more difficult by another current tendency. In a period of over-supply it is not difficult for independent operators to buy relatively small quantities of oil products at very favourable rates and sell them cheaper than the established companies in limited areas which are easy to supply. These operators are able to take advantage of short-term considerations, including abnormally low freight rates."

Production

The companies from which BP receives a share of crude oil output are shown in Table 1.

TABLE 1

Company	*BP Group Shareholding Per cent*	*Total Crude Oil Production* 1959 *Tons*	1960 *Tons*
IRAN:			
Iranian Oil Exploration and Producing Co. (through Iranian Oil Participants Ltd)...	40	44,677,000	50,991,000
IRAQ:			
Iraq Petroleum Co. Ltd ...	23¾	27,330,000	33,842,000
Basrah Petroleum Co. Ltd ...	23¾	12,297,000	11,396,000
Mosul Petroleum Co. Ltd ...	23¾	1,271,000	1,296,000
KUWAIT:			
Kuwait Oil Company Ltd ...	50	68,437,000	80,574,000
QATAR:			
Qatar Petroleum Company Ltd	23¾	7,867,000	8,083,000
EGYPT:			
The Anglo-Egyptian Oilfields Ltd*	31	510,000	1,073,000
TRINIDAD:			
Apex (Trinidad) Oilfields Ltd	100	415,000	387,000
Trinidad Petroleum Development Co. Ltd	78	862,000	881,000
Trinidad Northern Areas Ltd	33⅓	528,000	820,000
NIGERIA:			
The Shell-BP Petroleum Development Company of Nigeria Ltd	50	551,000	868,000
UNITED KINGDOM:			
BP Exploration Company Ltd	100	83,000	85,000
Scottish Oils Ltd (Shale Oil)	100	60,000	60,000
CANADA:			
Triad Oil Co. Ltd	51½	123,000	108,000
GERMANY:			
Gewerkschaft Norddeutschland...	100	6,000	7,000

*Figure for 1959 is for production after desequestration.

The Group obtained 74 million tons of crude oil in 1960 from producing companies in which it had shareholdings. This was some 9 million tons more than in 1959. Most of

the increase was accounted for by noticeably higher outputs in Iran and Kuwait, and by the Iraq Petroleum Co. Ltd.

The Basrah Petroleum Co. Ltd was one of the three companies in which BP had an interest to record reduced production. This resulted from a ten-fold increase in crude oil cargo dues at the Fao terminal in Iraq, which reduced the competitiveness of the oil.

Exploration

In Iraq, production began at Bai Hassan, west of Kirkuk. The first crude from this field was fed into the pipelines running from North Iraq to the Mediterranean in May 1960, and current production is running at 2 million tons/year.

The new Iranian field at Ahwaz also started production in 1960. At Pazanun, which lies south-east of Agha Jari, and where gas had already been proved, deeper drilling located an oil bearing zone. The commercial potential of this discovery is now being assessed.

Petroleum Development (Trucial Coast) Ltd, in which BP has a 23¾ per cent holding, made a commercial discovery at Murban on the Abu Dhabi mainland, and development drilling is now under way. Five offshore wells were completed by Abu Dhabi Marine Areas Ltd, and the field is expected to begin production in the second half of 1962.

Small discoveries were made in the U.K. at Apleyhead and South Leverton, in the East Midlands, and these are now being evaluated. The development of the new producing areas at Bothamsall, Gainsborough, Corringham, and Kimmeridge more than offset the decline at BP's original fields in the Eakring area, so that U.K. production rose from 83,000 tons in 1959 to 85,000 tons in 1960.

Twenty-three exploration wells were drilled in Nigeria, of which twelve found oil on test. In the Western Region, finds were made at Kokori, Isoki, and Patani. A second well was drilled at Ughelli, where the Region's first significant discovery was made in 1959. Further discoveries were also made in the Eastern Region.

The Group expanded its efforts in Libya to include further geological and geophysical work and three test wells. It also acquired a one-half interest in a large area in southern Cyrenaica, where a test well was started in December. Drilling also continued at several other locations.

Refining

The Group's total refinery throughput, including crude refined under processing arrangements, rose by over 8 million tons in 1960 to some 47 million tons. Details are given in Table II.

Movement of products at Grangemouth, where new tankage and rail loading facilities for fuel oil were commissioned, reached a record level. At Kent Refinery, new plant for the production of SBP spirits was commissioned in November, and a new catalytic reformer, BP's largest unit of its type to date, is under construction.

TABLE II

Company	*Refinery Location*	*BP Group share-holding per cent*	*Total throughput* 1959 *Tons*	1960 *Tons*
UNITED KINGDOM:				
BP Refinery (Kent) Ltd ...	Isle of Grain	100	7,138,000	8,391,000
BP Refinery (Llandarcy) Ltd	Llandarcy	100	2,824,000	3,145,000
BP Refinery (Grangemouth) Ltd	Grange-mouth	100	2,431,000	3,138,000
Scottish Oils Ltd	Pumphers-ton	100	140,000	145,000
ADEN:				
BP Refinery (Aden) Ltd ...	Aden	100	4,121,000	4,192,000
AUSTRALIA:				
BP Refinery (Kwinana) Ltd...	Kwinana	100	2,445,000	3,041,000
BELGIUM:				
Société Industrielle Belge des Pétroles S.A.	Antwerp	50	3,517,000	3,601,000
Tankage et Trans-port S.A. ...	Antwerp	100	141,000	142,000
CANADA:				
BP Refinery Canada Ltd ...	Montreal	100	—	550,000
EIRE:				
Irish Refining Co. Ltd (through Shell-Mex and B.P. Ltd) ...	Whitegate	16	680,000	1,411,000
EGYPT:				
The Anglo-Egyptian Oilfields, Ltd* ...	Suez	31	1,302,000	3,015,000
FRANCE:				
Société Française des Pétroles BP	Dunkirk	70	1,962,000	2,284,000
	Lavéra	70	2,349,000	2,658,000
GERMANY:				
BP Benzin und Petroleum A.G.	Hamburg	100	1,705,000	1,855,000
	Ruhr (Dins-laken)	100	—	1,265,000
Oelwerke Julius Schindler G.m.b.H. ...	Hamburg	99	293,000	313,000
IRAN:				
Iranian Oil Refining Co. (through Iranian Oil Par-ticipants Ltd) ...	Abadan	40	15,459,000	16,969,000
ITALY:				
Industria Raffinazione Oli Minerali S.p.A.	Venice	49	1,633,000	1,771,000
KUWAIT:				
Kuwait Oil Co. Ltd	Kuwait	50	7,055,000	8,806,000
LEBANON:				
Iraq Petroleum Co. Ltd	Tripoli	23¾	181,000	110,000

*Throughput after desequestration in that year.

The first of two crude oil distillation units came into operation at the new Dinslaken refinery in June, and by mid-September all units in the first stage of the project were fully commissioned.

Plant for the recovery of liquefied petroleum gases is due to be completed at Kuwait refinery soon. At Abadan, a new 20,000 bd catalytic reformer is scheduled for completion in 1962.

Petroleum Chemicals

BP's share of capital expenditure in petroleum chemical plants associated with its refineries in the U.K., Germany, and France, and in the manufacture of lead anti-knock additives, was £47 million at the end of 1960.

In the U.K., a third steam cracking plant was commissioned at Grangemouth in July, and in November a project to expand manufacture of styrene was completed there. Current construction work at Grangemouth includes plants to produce methanol, ethylene dichloride, and increased quantities of butadiene.

Sea Transport

The Group's own tanker tonnage, including that owned by tanker finance companies, totalled 144 ships of 2,701,000 tons at the end of 1960. This was 57,000 tons higher than in 1959. Nearly half the total tonnage was accounted for by vessels of 28,000 tons or more. In addition, BP had 50 per cent interests in associated fleets comprising 15 vessels of 323,000 tons. It also had about 2,600,000 tons of tankers on charter, compared with 2,800,000 tons in 1959.

The wholly or partly owned BP fleets at the end of 1960 are shown in Table III.

TABLE III

Company	*BP interest per cent*	*Number of vessels*	*Tonnage*	*Vessels on order or under construction*	*Approx. tonnage*
BP Tanker Co. Ltd BP Clyde Tanker Co. Ltd	100	106	1,647,000	30	1,365,000
Tanker Charter Co. Ltd ...	*	17	569,000	—	—
Clyde Charter Co. Ltd ...	*	13	293,000	—	—
Société Maritime des Pétroles BP	70	8	192,000	2	94,000
The Lowland Tanker Co. Ltd.	50	11	181,000	4	78,000
Warwick Tanker Co. Ltd	50	2	71,000	—	—
Nordic Tankships I/S, Copenhagen	50	2	71,000	—	—

*Tanker finance companies.

Sales

Total sales of crude oil and products in 1960 reached a record 73 million tons. This was nearly 10 million tons higher than in 1959.

Capital Expenditure

Total capital expenditure of the Group, including non-consolidated subsidiary companies and BP's proportion of the expenditure by associated companies, was made up as follows:

	1959	1960
	£	£
Exploration and production ...	34,750,000	36,750,000
Refineries	35,500,000	19,750,000
Tankers (before deducting sales under tanker finance arrangements) ...	24,000,000	9,750,000
Distribution and marketing facilities, etc.	42,250,000	39,500,000
Petroleum chemicals	4,250,000	6,250,000
	£140,750,000	£112,000,000

TOTAL ESTABLISHES ITSELF IN BRITAIN

The Compagnie Française des Pétroles is now firmly established in the retail motor fuels market in the U.K. Little more than six months after its British subsidiary, Total Oil Products (G.B.) Ltd, opened its first garage at Bushey Heath, Hertfordshire, more than fifty filling stations are selling its products.

Announcing this at a recent press conference, Total's newly-appointed managing director, L. J. Barnett, said that he expected this figure to have been doubled by the end of the year.

The Company's growth currently emanates from supply centres in London and Manchester and all the existing garages are sited within 60-mile radii of these cities. But plans are being developed for a rapid expansion of this network. These are believed to include the establishment of a new marketing area based on an East Anglian coastal depot. Such a depot would be ideally situated to receive supplies from the Holehaven terminal of London and Coastal Oil Wharves at Canvey, Essex, where Total products enter Britain.

Also understood to be under consideration is the appointment of independent distributors to carry out product distribution within certain specified areas.

Of the Company's two major building projects, which were described in the January 1961 *IP Review*, the new London depot at Swedish Wharf, Fulham, is over 60 per cent completed, and survey work is under way at the 20-acre site of the new £250,000 ocean terminal and storage installation at Stanlow, where the Company is presently renting storage facilities. The first barges from Holehaven should unload at Fulham later this year, and the Stanlow terminal is scheduled to come into operation in June 1962.

Total claims that its dealer policy, said to be more flexible than is traditional in Britain, is one of the key factors responsible for its rate of progress. Except where it has made an investment in a garage, it does not seek an exclusive contract or long-term agreement with the operator. Total aims to attract the British motorist by offering him a standard of service at its filling stations "at least equal" to that enjoyed by his American counterpart. Whether or not the British motorist wants service on American lines has long been a question of controversy and marketing specialists will no doubt be studying the results of Total's efforts in this direction very closely.

The Company is currently building the first-ever prefabricated garages in Britain at two sites near Purfleet in Essex. They are mainly of fire-proofed timber and glass construction and have an estimated life of 20 years. These new buildings were developed by Total's engineering department in Britain and can be adapted to conform, within limits, to almost any shaped site.

All components, including plumbing and electrical fittings, arrive on site ready-made. Erection is completed within 3 to 4 weeks against the usual 12 to 14 weeks for a conventional bricks and mortar structure.

Total has no plans to operate its own filling stations in Britain. With the possible exception of a staff training garage, all newly-established stations will be leased out to private operators.

Branch of the Month:

The Fawley Branch

Fawley refinery seen from the air. Fawley church, which can be seen in the foreground, is a fine example of Norman and early English architecture

Ponies and Polymers

The New Forest . . . some people will recall the long roads west from Southampton and Romsey, stretching through miles of heath and woodland, where the driver must constantly be alert for a pony wandering into his path. Others will remember visits to Beaulieu, to Lymington, or to Lyndhurst.

The Perambulations, or boundaries, of the New Forest stretch from close by Southampton in the east, nearly to Bournemouth in the west. They encompass some 144 sq miles. About 42 sq miles of this land is privately owned and is enclosed, but over the rest roam the Forest animals. "Commoners" have ancient rights of pasture on the Forest for their ponies and cows. There are wild animals in plenty, and one may occasionally glimpse the Forest deer, descendants of the animals hunted by the Norman kings. For it was William the Conqueror who decreed that this land should be preserved as a royal hunting ground and set its boundaries.

Although the population of Hythe has increased ten times in recent years, the High Street remains as picturesque as ever

The history of the New Forest goes back much further than 1066. At Fawley, which is in the south-east corner of the Forest, near the shore of Southampton Water, we know there was a Saxon settlement in 800 A.D. Two or three miles to the south of Fawley, on the shore of the Solent near Lepe, there was probably a Roman port. Practically no trace of this port remains to-day, but it is likely that it was of importance at least until the 14th century. It was from Lepe that Conan Doyle's "White Company" took ship for France.

Five miles to the west of Fawley is Beaulieu, now well-known as the site of jazz festivals and of the Montagu Motor Museum. It was in 1204 that King John granted a charter to the Cistercian monks to found a monastery in this *bellus locus*, or fair place—in Norman French *beau lieu*. The Abbey flourished for over 300 years. The monks were fine farmers and foresters and the river, navigable from the Solent, served not only to bring in the building materials that they needed, but also to transport the wool and other produce which they had to sell.

When the monastery was dissolved by Henry VIII in 1538, the land and buildings were sold to the first Earl of Southampton for £350 6s. 8d. The land later passed by marriage to the Montagu family, the present owners. The buildings of Beaulieu Abbey have largely been demolished, and the stone, lead, and timber used for new building. The Governor's House at Cowes in the Isle of Wight, which is now the premises of the Royal Yacht Squadron, was built of materials from Beaulieu. The original Great Gate House of the Abbey was enlarged and converted into a private residence soon after the dissolution; as Palace House it is the home of the present Lord Montagu.

Down river from Beaulieu is the hamlet of Buckler's Hard. This village was built early in the 18th century by the Duke of Montagu, who hoped to establish a port for the sugar trade to rival Bristol and London. His plan did not succeed, but in 1744 one, Henry Adams, founded a shipyard there and built ships of the Forest oaks. The shipyard

A refinery never stops growing . . . construction work on the new chemical project at Fawley

thrived until the early part of the last century and the firm built in all fifty-five men-of-war and twelve merchant ships.

Industrial Development

On the eastern side of the New Forest is Southampton Water. At its southern end, 2 miles south-east of Fawley, lies Calshot, where, until earlier this year, there was an R.A.F. Flying-Boat base, which was made famous by the Schnieder Trophy races. Southampton itself, 6 or 7 miles north of Fawley, is to-day not only a great passenger port, but also the centre of Britain's fastest-growing industrial area.

Fawley itself is the site of one of the most spectacular of these industrial developments, which has had far-reaching effects on the life of this part of the New Forest. In 1920 the AGWI Petroleum Co. Ltd started building a fuel oil tank farm on the marshes bordering Southampton Water. Refining units were added and by 1939 Fawley Refinery represented a considerable proportion of Britain's oil refining capacity. The impact of this refinery was, however, limited to the immediate district.

In 1946 the AGWI Company, which had been for several years a subsidiary of Standard Oil (New Jersey), was merged with the Esso marketing affiliate in the U.K., Anglo-American Petroleum Co. Ltd, now Esso Petroleum Co. Ltd. In 1949 the Company started work on a new 140,000 bd refinery on a site, formerly part of the Cadland Estate, adjoining the pre-war plant. It came on stream in July 1951, some 5 months ahead of schedule.

Expansion has continued. To-day the 240,000 bd Fawley refinery is the largest refinery in the Commonwealth. The process units include a cat cracker, two catalytic reforming plants, and petroleum chemicals feedstock plants. Currently under construction is a second petroleum chemicals project, which will greatly increase production of ethylene and butadiene. Planned future developments include the construction of a butyl rubber plant.

The refinery and the nearby plants of International Synthetic Rubber Co. Ltd, Monsanto Chemicals Ltd, and Union Carbide Ltd, built to process butadiene or ethylene produced at Fawley, have brought many changes to the area and have increased greatly local prosperity. The town of Hythe, some miles north-west of Fawley, has grown ten-fold in population over the last few years and it is anticipated that its present population of 10,000 will double in the foreseeable future. Development remains, however, within a limited area. A few minutes' drive from the towers, tanks, and chimneys of the refinery and from the new roads built to serve it, are undisturbed Forest tracks.

The Inaugural Meeting

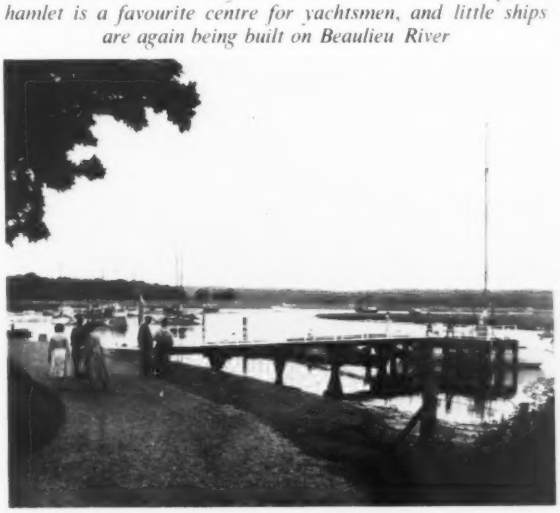
The Fawley Branch of the Institute of Petroleum was inaugurated in May 1949. The twenty-one founder members included George Noble, who retired recently as a director of Esso, I. McCallum, now manager of the Irish Refining Company's Whitegate Refinery, Dr A. W. Pearce, now general manager refining of Esso, and Dr Frank Mayo, refinery manager at Fawley since 1951.

The first meeting of the Branch was held in October 1949. Professor F. H. Garner, of the University of Birmingham, presented a paper on "The Chemical Engineer in the Petroleum Industry". Since then the Branch has enjoyed many notable speakers and valuable discussions at its meetings. Among the most memorable meetings have been those held jointly with the Royal Institute of Chemistry, such as the joint symposium held in 1960 on "The Disposal of Industrial Effluents". It is planned to hold another such symposium next year on "Petroleum and Chemicals in Agriculture".

Whilst most of the present 150 members of the Branch work at the host establishment, Esso Refinery, there are a number of members from the Shell installation at Hamble and from the Shell Mex and B.P. Divisional offices in Southampton who have, from the beginning, been active in Branch life. About half of the members are corporate members of the Institute. Although no member from Fawley has yet been elected to Council in his own right, Messrs I. McCallum, S. A. Berridge, and C. W. Banyard have served on Council as representatives of the Branches Committee. The Branch plays an active part in the Institute's sub-committees, panels, and technical committees. Currently, some seventeen people from Fawley serve in this way.

Fawley is in a lively and rapidly-developing part of Britain. It is appropriate that this young Branch of the Institute of Petroleum should be lively and developing too.

Buckler's Hard, where the 64-*gun* Agamemnon, *Nelson's command at the Battle of St Vincent was built. To-day, the hamlet is a favourite centre for yachtsmen, and little ships are again being built on Beaulieu River*



*Some Aspects of the Manufacture of Chemicals from Petroleum**

By E. J. G. TOXOPEUS†

There has been an increasing tendency in recent years to use the expressions "petrochemicals" and "the petrochemical industry", but the use of either in the title of this paper has been deliberately avoided for the following reason:

The chemical industry, both organic and inorganic, employs a wide range of raw materials. Sometimes different raw materials are used for the manufacture of the same product and although there are a number of factors governing the choice of the raw material which is utilized at any one time, the economic factor is, generally speaking, the predominant one.

There is, however, no logical reason whatever for segregating a part of the chemical industry and calling it "the petrochemical industry", since it is the chemical industry which is simply using petroleum as a raw material complementary to and supplementing other raw materials such as coal and vegetable products which it had used for many years for manufacturing, in a number of instances, the same final chemical products. I therefore prefer to discuss the manufacture of chemicals from petroleum.

My company has carried out considerable pioneering activities in the field of the utilization of petroleum products for the manufacture of chemicals. We are still as enthusiastic as ever about the possibilities of this field of activity and are confident of its continuous future growth. Conversely, however, we are equally convinced of the fact that in considering projects for the manufacture of chemicals from petroleum one has to consider very carefully the many aspects that are connected with it and some of these I would like to develop in this paper.

Petroleum as a Base Material

In the first place let us look at the importance of petroleum as a base material for chemicals in quantitative terms. Although oil companies were the pioneers in the use of petroleum as a base material for chemicals, the established chemical companies were very quick to take advantage of this abundant new source of raw material for their industry and they are now by far the largest consumers of oil products for chemical manufacture, accounting between them for about two-thirds of the total chemical production based on petroleum.

The world production of chemicals manufactured from petroleum continues to grow rapidly and in fact faster than the chemical industry as a whole. At the same time, care should be taken not to over-estimate the importance of the chemical industry as a consumer of petroleum products. Not much more than 2 per cent of the world production of crude and natural gas is used to-day for the manufacture of chemicals.

In the United States, where the consumption of chemicals and chemically derived products is per capita higher than in any other country, less than 2 per cent of their natural gas production is used as a raw material for manufacturing chemical products—that is to say 570 million cu ft day, whereas 98 per cent is used for energy purposes. This consumption of natural gas as a raw material for chemical synthesis in America which has been achieved over the last 30 years has involved a capital investment running into many millions of dollars.

As an indication of the consumption of natural gas in chemical plants it is interesting to mention that a synthetic ammonia plant producing 150 tons day requires only 3·7 million cu ft day of natural gas as a raw material, plus 2·2 million cu ft day as fuel, whilst a methanol plant producing 120 tons day requires 2·4 million cu ft day of natural gas as raw material and 2·8 million cu ft day as fuel.

Turning now to the Middle East, the present total surplus of natural gas is estimated at 1·8 milliard cu ft day, and it is natural to speculate how this surplus can usefully be consumed and how the creation of a chemical manufacturing industry could contribute. Judging by experience elsewhere, such a contribution could only be marginal.

In the whole United States, a country which over the years has achieved the highest level of industrialization in the world, the total consumption of natural gas in chemical manufacturing has even now only reached a figure about equal to one third of the Middle East natural gas surplus. Any country on the threshold of the development of a chemical industry could not expect to use more than a small fraction of this surplus.

The Industrial Scene

Let us now turn to the overall industrial picture. The organic chemical industry, and here you will notice that the manufacture of inorganic products such as ammonia and other fertilizers are excluded, is a part of a complex of an advanced and comprehensive chemical industry and this is very dependent upon a highly industrialized economy. The products manufactured are not, generally speaking, articles for immediate consumption but are specialized products which are then used as raw materials by other branches of industrial activity either in or for the manufacture of finished consumer chemicals or other articles of consumption or use.

For example, a wide range of industrial solvents manufactured from petroleum is sold to the paint and lacquer industry. Soap companies are purchasing a range of base materials made from petroleum for conversion into finished detergents. Plastics are sold to a variety of companies who then process them by utilizing techniques such as extrusion, moulding, vacuum forming, etc. At the same time such an industry requires a host of other chemicals in varying quantities such as sulphuric acid, caustic soda, lime, chlorine,

*This paper was read at the Second Arab Oil Conference in Beirut in October 1960.

†Bataafse Internationale Chemie Mij.

fatty acids, and alcohols, and also catalysts, stabilizers, etc. which are normally not produced from petroleum.

These examples illustrate the validity of an old expression which says that the chemical industry is its own best customer. Expressing it another way, the organic chemical industry, generally speaking, cannot exist in a vacuum but is an essential and integrated part of the economy of an industrialized country.

Looking now at the marketing aspects, the author is strongly of the opinion that a sound chemical venture is generally based on the bulk of its production being sold in local markets. If a plant is erected which is dependent essentially on exports, its economic success will depend upon a number of factors which may change rapidly from time to time, such as import restrictions, licences, new duties, and not least the economic climate of the purchasing countries. Application of any of these factors may result in the plant having to operate for a time below economic level. This will make it difficult for that plant to compete with plants operating in a country where a large part of the capacity is always assured of an outlet in a developed and stable market.

Technical Service

The sale of all chemicals demands a considerable amount of technical service to customers, more particularly is this so for products such as thermoplastics and synthetic rubbers, the quality of which is judged by their performance in the customers' processing equipment. The sale of these products requires close and frequent co-operation between the technical staff of the users and the technical personnel in the organization of the producer.

Factors contributing to the success of a venture may depend in no small measure on the experience of the marketing staff who must have a keen appreciation of the requirements of customers, backed up by an efficient technical sales service and product development laboratory. The closest linkage between the sales and manufacturing division of the chemical company also becomes of paramount importance since the ability to make quickly a minor change in operating conditions in the plant to meet customers' performance requirements may, in highly competitive markets, make all the difference between selling and not selling. This aspect should not be under-estimated, considering that in export markets one may be competing with a local producer who already has the advantage of shorter supply lines and who, due to geographical proximity of marketing, manufacturing, and research, is also in a position to meet the performance requirements of the customer with a minimum delay.

Apart from the freight cost angle, long hauls for one's products also increase the chances of contamination or, in the case of some sensitive products, of deterioration so that the product arrives off-specification. The foregoing serves to illustrate the fact that a venture which is based on exports for the bulk of its production is in a disadvantageous position.

A typical feature of the manufacture of chemicals from petroleum is that suitable petroleum fractions are used for manufacturing the "building blocks" which are subsequently used in chemical synthesis. Examples of these building blocks are ethylene, propylene, butylenes, benzene, acetylene, butadiene. These are put together or combined with other materials by processes which are often catalytic, requiring many steps each with its reaction and purification sections. As an example, the manufacture of styrene–butadiene–rubber is based on the copolymerization of butadiene and styrene, a reaction which has been described in detail on many occasions and which requires a multitude of carefully controlled subsequent steps to produce a certain grade of rubber. It is quite sobering to realise that a normal SBR plant produces some 10–20 grades of rubber, each grade requiring its own special conditions.

The base materials, styrene and butadiene, can be manufactured from petroleum in a number of separate process steps. To list them briefly, ethylene is produced from a suitable petroleum feedstock in a cracking operation, followed by a special distillation step; benzene is extracted from a specially reformed petroleum cut. These two materials are catalytically combined to form ethylbenzene. After purification the ethylbenzene is catalytically dehydrogenated to form styrene.

Butadiene is catalytically produced from *n*–butylene or *n*–butane which are extracted from a C4 fraction in an involved operation.

This technical detail has been included in order to make a comparison with the manufacture of natural rubber. Here the trees can be considered as forming a number of separate small production units. While not underrating the benefits to be derived from large production combines, even a small natural rubber producer, due to his smaller overheads, can, if he is competent, still make a reasonable living.

High Costs

On the other hand, in view of the many process steps involved, each requiring its own synthesis, recovery, and purification sections, the cost per unit of production of synthetic rubber is high. As an illustration the manufacture of SB rubber can be used. The capital outlay can vary between $20 and $35 million (*i.e.* $400–$700 per annual ton) for a 50,000 tons year unit according to the availability of base materials or whether they have to be manufactured separately. On the other hand, a unit of 20,000 tons year capacity (*i.e.* 40 per cent of the capacity) will cost between $10 and $20 million (*i.e.* $500–$1000 per annual ton). Here you see the effect of size on capital, and this in turn also affects the operating cost which can be under these circumstances some 20 per cent higher in the smaller plant. Under certain circumstances this could mean the difference between profit and loss.

Although there are exceptions, this feature is typical of the chemical industry based on petroleum. Its capital investment is high and consequently its economics are very much dependent on the size of its activities.

Considering the foregoing in conjunction with the author's previous remarks on local markets, it is clear that a sizeable local market is necessary before the manufacture of chemicals from petroleum can be justified economically. This market, as was discussed earlier, lies in the consuming industries. Plastic processing plants, rubber consuming plants, paint and lacquer manufacturers should be established first. In contrast with the manufacture of chemicals from petroleum the economics of the typical consuming industries are generally less dependent on size and consequently they can be built up stepwise.

When such industries are established the next step in the development of the country's economy could be the local production of chemicals from petroleum. Even so, such development may involve the establishment of a heavy inorganic chemical industry which would provide other

process materials such as chlorine, caustic soda, sulphuric acid, etc., at an economic cost.

The Need for Skilled Personnel

Quantitatively, the type of plant that has been discussed does not normally provide employment for large numbers of unskilled or semi-skilled labour. Here there is quite a similarity with oil refining operations. A high degree of automation is necessary to ensure consistent production of high-quality material.

To give some examples; the synthetic rubber complex mentioned above would require some 400 to 500 people for its operation, both in actual plant operation and related services, *i.e.* maintenance, laboratory, etc. A polyolefins complex, including the manufacture of the olefins from cracking of a suitable petroleum fraction, will employ some 250 people and these numbers do not vary greatly with the capacity of the plants.

On the other hand, chemical plants of all types, and particularly those producing highly specialized organic chemicals, require experienced technical personnel of all types. My company's own experience in recent years in the industrialized countries has shown that there is by no means a surfeit of such personnel and it is true to say that non-availability has on occasions posed considerable problems. The standard must be high and especially the supervisory personnel should have had as wide an experience as possible, extending over a variety of chemical operations, so that they are well qualified to tackle the many difficult problems which may arise in the operation of their chemical plants. In view of the high cost of the products manufactured, greater vigilance is necessary for the operation of these plants than for other manufacturing processes since losses stemming from any deviation from the essentially high standard of operation and maintenance leading to long shut-downs will soon result in considerable financial losses.

A continual flow of skilled personnel, ranging from chemists, chemical engineers, electrical and construction engineers, and skilled craftsmen of all types, is required for this industry. While it may be possible to employ skilled personnel from elsewhere in the initial period, eventually these skills must be provided locally. This necessitates a constant flow of personnel well grounded in the fundamental basic training in the particular science or field of endeavour which they have studied in universities, technical colleges or training centres, either at home or abroad.

Finally, it should be repeated—as much for the benefit of the author's friends in the oil industry as for anyone else—that the production of chemicals from petroleum is essentially an integral part of the chemical industry and not of the oil industry.

Many of the end-products manufactured from petroleum are, in fact, currently manufactured from other raw materials but the properties of these chemicals are naturally not in any way affected by the raw materials from which they are derived. The development of this type of operation should be an integral part of the development of the total chemical industry in a country. As has been pointed out, there should be consuming industries and supporting industries, with the consuming industries breaking the ground to create the conditions, markets, industrial skills, etc., which are necessary for the establishment of this intriguing and fascinating field of activity; the manufacture of chemicals from petroleum.

RISE IN NORTH AMERICAN RESERVES OF LIQUID HYDROCARBONS AND NATURAL GAS

Proven recoverable reserves of liquid hydrocarbons in the U.S.A. rose by 187,615,000 brl in 1960 to a record level of 38,429,270,000 brl. These figures are given in the latest joint report of the API and the American Gas Association.

The increase was due entirely to a rise of 293,751,000 brl in the proven reserves of natural gas liquids to 6,816,059,000 brl, for reserves of crude oil fell by 106,136,000 brl to 31,613,211,000 brl. This drop followed gains in crude reserves in 1958 and 1959. Since the increase in 1959 was 1,183,430,000 brl, crude reserves remain well above the 1958 level.

Following a rise in 1959 of 537,458,000 brl, the first for three years, proven crude oil reserves in Texas fell by 101,182,000 brl to 14,758,492,000 brl. But with an increase of 165,799,000 brl in proven reserves of natural gas liquids, the State recorded an overall increase in proven reserves of liquid hydrocarbons of 64,617,000 brl, and at the end of the year these had reached 18,354,666,000 brl.

The largest decrease in crude reserves occurred in California, where the total of 3,658,542,000 brl was 103,965,000 brl lower than in 1959. Unlike Texas, proven reserves of liquid hydrocarbons also fell and stood at 3,972,403,000 brl, 115,422,000 brl less than in 1959. By contrast Louisiana strengthened its place in second position to Texas with additional proven reserves of 125,292,000 brl of crude oil, which had reached a total of 4,785,380,000 brl, and a total increase in proven reserves of liquid hydrocarbons of 200,469,000 brl to 6,218,355,000 brl.

Proved recoverable reserves of natural gas in the U.S. continued to climb achieving their highest ever figure of 263,702,220 million cu ft. But the increase for the year of 1,105,627 million cu ft was the second smallest in post-war years, and compares with an increase of 8,454,556 million cu ft in 1959. Proven reserves in Louisiana rose by 3,532,221 million cu ft to 63,386,141 million cu ft, but in Texas reserves of 119,479,915 million cu ft were 995,868 million cu ft below the 1959 level.

Canada

Figures issued simultaneously by The Central Reserves Committee of the Canadian Petroleum Association show that total proven recoverable reserves of liquid hydrocarbons in the Dominion rose by 217,794,000 brl to 4,217,063,000 brl. Of this total crude oil reserves of 3,678,542,000 brl were 181,418,000 brl above the 1959 level, and reserves of natural gas liquids of 538,521,000 brl were 36,376,000 brl higher.

Alberta achieved the biggest advance in crude oil reserves with an extra 152,314,000 brl and at the end of 1960 these had reached 13,051,192,000 brl. Those in British Columbia climbed by 25,555,000 brl to 44,956,000 brl. There was also a smaller increase in Saskatchewan crude reserves, but those of the Northwest Territories and Manitoba showed a decline.

Canadian proven reserves of natural gas rose by 4,068,716 million cu ft to 30,674,052 million cu ft.

Books and Films

Hydrocarbon Oil Duties (Drawback) Order

The Hydrocarbon Oil Duties (Drawback) (No. 1) Order, 1961 has been published by The Treasury as Statutory Instruments 1961, No 553.

Under the order, the rate used for determining the quantity of hydrocarbon oil in respect of which drawback is allowed on the export of certain solid woven belting is increased from 1·6 gals/cwt to 1·9 gals/cwt. The allowance of new drawbacks of Customs or Excise duty paid in respect of hydrocarbon oil used in the manufacture of solid neoprene synthetic rubber, neoprene latex, and certain lubricating oil viscosity modifiers, is also covered by the order.

BCMPA Report

The British Chemical Plant Manufacturers Association states in its Annual Report for 1960 that several member firms had experienced difficulty in obtaining chemical engineers in the 30–35 age group.

The report records that both the Association and the Association of British Chemical Manufacturers had asked their members for their views on the fields in which further research was needed. From the replies the chief ones appeared to be: Mixing, particularly of solids and non-Newtonian materials; Heat transfer, especially from two-phase systems; Size reduction and separation; and Gas cleaning.

Although capital expenditure by British chemical and allied industries was lower than in 1959 and considerably less than in 1957 and 1958, the state of order books in the industry was generally considered highly satisfactory.

Canada's New Nickel Producing Area

The International Nickel Company of Canada, Ltd began its search for nickel deposits in Northern Manitoba in 1946. Ten years later, after many setbacks, the Company announced the $185 million Thompson project to exploit a great new orebody discovered near Moak Lake.

In four years a complete new town and a 250-acre industrial plant have been built on what was previously a rugged and untamed region, and to-day it is the centre of the second largest nickel operation in the free world. The town of Thompson will eventually house 8000 people, and the nearby mine, with its associated mill and refinery, will soon be producing 75 million lb of nickel a year.

The story of "The Thompson Project" makes interesting reading, and is told in a new booklet available from The International Nickel Co. (Mond) Ltd, Thames House, Millbank, London, S.W.1.

Elaborate Precautions Mean Absolute Safety

The elaborate precautions taken at a chemical factory in the handling of highly flammable materials are portrayed in a new film, entitled *Safety and Solvents*, made at the Salt End factory of the Chemical Division of the Distillers Company in Hull.

The film deals particularly with the steps taken to prevent the generation of static electricity. The stringent methods used at every stage of production and the extreme caution with which the goods are handled are shown in detail, sometimes with the help of animated diagrams.

The film opens when the raw materials for the factory are still at the Grangemouth plant of British Hydrocarbon Chemicals. It continues to show them arriving by sea tanker at Hull, and follows them through each individual process until the finished products are ready to leave the factory. The impressive respect with which the materials are handled may appear almost obsessive, but they add up to that most important thing—absolute safety.

The film is available on free loan from the Publicity Department of D.C.L.'s Chemical Division at Devonshire House, Mayfair Place, London, W.1.

BEAMA Guide to Arc Welding Electrodes

The British Electrical and Allied Manufacturers' Association has published a new and completely revised 100-page edition of its "Guide to Arc Welding Electrodes", which gives classified lists of British electrodes and a key to American and British Electrode Standards.

The Guide, now in its sixth edition, includes a brief description of the British Classification of Electrodes, published by the British Standards Institution as BS 1719:1951. A more complete description of the American method of classifying electrodes is given, and the equivalent American Code numbers are shown in all the classified lists.

There is also a section giving information on special electrodes and lists of the special electrodes available.

The Guide, price 5*s* 0*d*, is available from The British Electrical and Allied Manufacturers' Association, 36 Kingsway, London, W.C.2.

Achievements 1960

Pat Moss and Ann Wisdom, the foremost ladies' rally team in the world, take pride of place in Castrol's 48-page *Achievements Book 1960*. The book includes more than 100 pictures, and is an exciting record of races, rallies, records, trials, and scrambles in all parts of the world.

The cover pictures are in full-colour and show Pat Moss and Ann Wisdom winning the Liège-Rome-Liège Rally in an Austin-Healey, the Swedish rider Bill Nilsson, world moto-cross champion for the second time, and a Ford Zephyr taking part in the East African Coronation Safari.

Achievements Book 1960 is obtainable free from Castrol Ltd, Castrol House, Marylebone Road, London, N.W.1.

Universal Oil Products Co. in 1960

Profits and product sales of the Universal Oil Products Company both showed moderate increases in 1960. And the number of licences issued for the use of UOP processes was higher than ever before, with about 50 per cent of them being granted to overseas companies.

UOP's annual report shows that net income for the year reached $3,548,485. The total for the previous year has not been published, but between 12 February 1959, when UOP became a publicly-owned company, and 31 December 1959 net income was $3,243,202.

UOP's research and development costs rose by 8 per cent in 1960 to $7½ million. The number of U.S. and foreign patents granted to the Company during the year totalled 325, and the annual report states that UOP ended the year with more than 1700 U.S. and 1600 foreign patents.

Equipment Developments

Tele-Reader Vehicle Fuelling

A prototype of a new system of retail dispensing of motor fuel—"Tele-reader Fuelling" has been developed by Wayne Tank & Pump Co. to meet the requirements of Shell International Petroleum Company.

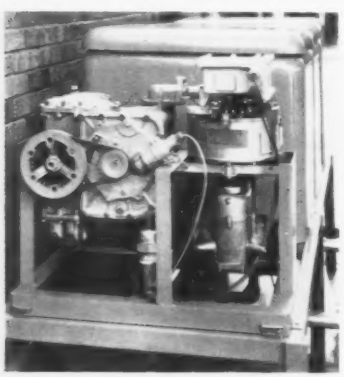
The units of a conventional motor fuel pump are separated and sited in the most favourable positions for efficient and flexible

New Wayne pumps and the "Tele-reader"

forecourt operation. Pumps and meters are placed adjacent to storage tanks, fuelling points and controls are on the forecourt area. Storage tanks need no longer be installed beneath the forecourt and thereby tanker deliveries need no longer impede the service area.

The "Tele-reader" electro-mechanical indicator incorporates large easily-read figures showing the grade and quantity being supplied, price per gallon and the total cash value of the sale and is sited in the motorist's direct line of vision. After delivery, according to quantity or price, an interlocking device ensures the automatic return of the drum readings to zero. Each reader is connected by push button control to the fuelling point. At no time is it necessary for the motorist to leave his vehicle or the operator the fuelling point.

While the prototype is a simple four-product unit with dual "Tele-reader" it is said that such additional equipment as pre-sets, octane blending, etc., could easily be incorporated. Octane blending is based on the Wayne "Blend-O-Matic" pump, offering up to nine grades of fuel from a single hose outlet. Without increasing the number of "fill-points" two customers could each be supplied simultaneously with a choice of nine grades of gasoline plus derv fuel and gasoline oil two-stroke mixture.



A Master Meter unit showing the standard solo pumping unit and 2 PM meter

Digital System for Process Instruments

Recent developments by Rotax Ltd include a digital system for remote indication and recording of data from conventional process measuring instruments. The basis of the system is analogue to digital conversion at the instrument shaft without appreciable additional loading of the movement. It can be fitted to pressure gauges and other instruments, converting them to digital transmitters. Transmission of data readings can be automatic or manual, either single or as part of a complete data logging system.

The Company's Process Control Group has also announced a 30v 3 amp fully transistorized power supply unit, which includes a new filter circuit. The stabilized voltage output is variable from zero to maximum, overall stability factor 1 : 1200, and dc resistance less than 0·01 Ω.

Firth Cleveland Tangential Fan

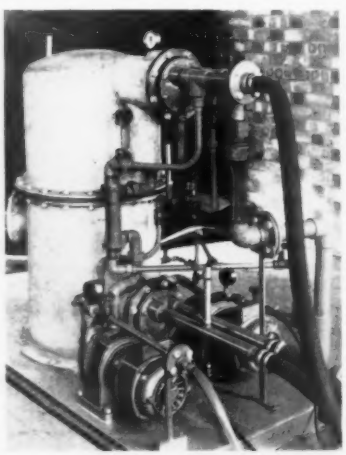
The Firth Cleveland Tangential Fan utilizes a completely new principle to eliminate the stall barrier which restricts the effectiveness of small conventional slow speed fans. The problem of turbulence caused by air clinging round the leading edges of the blade is overcome by arranging the impeller blades cylindrically to start up a vortex of air, and to keep it spinning within the cylinder. The periphery of the vortex, rotating at a speed up to six times that of the circumferential speed of the impeller, picks up the inflowing air and ejects it between the blades at a speed which is double the speed per unit frontal area at a given speed for a conventional fan.

With turbulence eliminated, the tangential fan has an efficiency up to three times that of the traditional fan and a noise level as little as one-tenth that for a fan of given size.

Initially, it is being manufactured for use in domestic appliances such as room heaters, but it is also expected to have important applications as a pump for moving viscous fluids and light, hot, or rarefied gases.

Medium Capacity Evaporators

New AMF-Maxim *Aquavap* evaporating and distilling units, which can produce from 300 to 10,000 gpd of high-purity water from salt or brackish water, are designed for use at drilling sites and for other applications where larger units are impractical or uneconomic. Because they operate on the heat recovery principle and can be connected to utilize the waste heat in diesel engine jacket water, fuel costs are negligible. The small amount of electrical power required to operate the pumps and salinity panel is normally not enough to necessitate an increase in generator capacity.



AMF-Maxim "Aquavap" model VJ20 with a fibre glass shell

The heat source required is 150 F or more, which is sufficient to boil the raw water under vacuum in the lower section of the evaporator shell at 125 F. By passing the resulting vapour through a specially designed separator before it reaches the distiller condenser tubes, a water purity of 0·25 gr/gal is achieved. Because of the low temperature boiling, the scaling problem caused by sea-water is claimed to be practically non-existent.

AMF-Maxim *Aquavaps* are made in three standard models, the *VJ*20, which has an output of 290–830 gpd: the *VP*150, 2080–6230 gpd; and the *VP*250, 3460–10,380 gpd. Where weight must be kept to a minimum the evaporator shell can be made in reinforced glass-fibre plastic.

Descriptive literature is available from AMF Ltd, Maxim Division, 4–6 Savile Row, London, W.1.

Trade Literature, etc.

Preparation of Geological Specimens

Recent experiments at the Royal School of Mines have shown that in the preparation of thin sections of certain friable rocks and sediments for microscopic examination, the breakdown of the specimen due to its brittleness and incoherence can be overcome by impregnating the specimen, prior to sectioning, with a polyester resin, such as *Bakelite* Resin DSR. 19098.

The method adopted is to cut a 3mm–4mm thick section from the specimen, or if it is considered unwise to attempt to cut a slice, the whole lump can be impregnated with resin and treated after hardening as a normal hard rock. The sample is dried at 105°C and then immersed in the polyester resin. The sample and resin are heated to about 75°C and held at this temperatire for about twelve hours. The temperature is then raised to about 125°C and held for a further 12–24 hours. On cooling at room temperature it should be hard enough to resist indentation with a mounting needle.

Polydiene Rubbers Licence for Shell Chemical Co.

A licence for the manufacture and marketing of polydiene synthetic rubbers in the U.K. has been granted to Shell Chemical Co. Ltd by Goodrich Gulf Chemicals Inc. of Cleveland, Ohio. The company already holds licences under patents held by Professor Karl Ziegler of Germany to use catalysts developed by him for the manufacture of polybutadiene and polyisoprene rubbers.

Drilling Mud Production in Iran

A new plant to process drilling mud weight material and lost circulation products started operations at Parandak, 100 miles south of Teheran, recently. It is run by Sherkat Sahami Magcobar Iran, an affiliate of the Magcobar Division of Dresser A.G.

Initially, marketing of the products will be carried out in Iran, but there are plans for exports to be made to Iraq and other nearby countries.

Engineering Laboratories

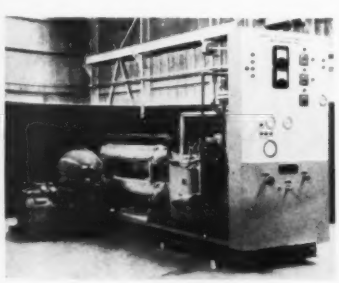
Soil Mechanics Ltd and Griffin & George Ltd have formed a new company, Engineering Laboratory Equipment Ltd, for the design, building, and equipping of engineering laboratories for both research and general commercial practice. In addition the Company will supply site and mobile laboratories to building contractors and local authorities.

Rust Inhibitor for Domestic Kerosine

The new anti-rust additive which is included in the premium grade of domestic kerosine marketed by Shell-Mex and B.P. Ltd was discovered at the BP Research Centre at Sunbury. The project is understood to have involved considerable research. The first European company to market domestic kerosine containing the additive was BP Holland.

Shell's New Product for Farmers

Following the decision by manufacturers of agricultural chemicals to cease manufacture of sodium/potassium arsenite potato haulm killers, Shell Chemical Co. Ltd has introduced a new, non-toxic, haulm destroyer to be known as *Holtox*.

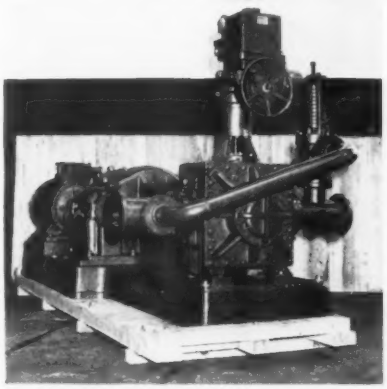


The fuel oil washing process before installation in the Partula

Sharples Fuel Washing Process

A fuel oil washing process manufactured by Sharples Centrifuges Ltd is being tested in the Shell tanker *Partula*. The process incorporates the Sharples *Gravitrol* 1000 centrifuge. When it was installed in a tanker owned by the Atlantic Refining Co. of Philadelphia it is claimed that it virtually ended slagging in the superheater section of the boiler.

Pumps for Oil India Pipeline



The Plenty "Universal" Pump

The first two of twelve *Universal* pumps manufactured by Plenty & Son Ltd of Newbury for the 720-mile Oil India Pipeline are now on their way to Nunmati. The pumps are fitted with *Rotork* actuators for local and remote control and will be used to transfer crude from the local pumping station to the refinery storage tanks.

The Company is also supplying two of its *General* pumps for oil recovery from oily water separators, and ten other pumps with remote air diaphragm control.

Metering Equipment for Oil India Pipeline

The de Havilland Aircraft Company's Pottermeter turbine type flowmeters are being supplied for use in conjunction with local and remote direct-reading totalizers and rate of flow indicators for the new 720-mile pipeline under construction in north-east India.

The de Havilland Pottermeter flow sensing element is based on a new principle, using the kinetic energy of the measured fluid to suspend the turbine type rotor in an axial "floating" position. The alternating current generated by the rotor is fed into totalizers and rate of flow indicators which record direct in cubic metres and cubic metres/hour respectively.

Kestners on the Move

Kestner Evaporator & Engineering Co. Ltd has started the transfer from its Kestner works at New Cross, London, to Greenhithe, Kent. All departments are expected to be installed in the new premises by the end of the year.

Water-Cooled Compressors

Worthington Corporation, whose products include pumps and compressors, and air conditioning, heating, and construction equipment, has appointed Eastman Equipment Company, of San Jose, California as distributor of its air-cooled and water-cooled compressors, in the state of California.

New Flame Controllers

A new range of flame controllers for safely igniting and monitoring multi-burner installations in industrial concerns has been developed by Ether Ltd. Known as Series 704 flame controllers, they can control up to six flames at once. Each flame is controlled by a "flame-eye", comprising a lead-sulphide cell, and a transistor amplifier which is sensitive to the modulated component in the flame-radiation.

New Anti-Corrosion Technique in Tanker Construction

A new anti-corrosion technique was used in the 48,000-dw ton Shell tanker *Ondina* which was launched in Rotterdam recently. Before construction started, a 10 microns thick primer of Shell *Epikote* resin containing a high percentage of zinc dust as pigment was applied to the steel plates, which had previously been shot blasted to clean off scale left by the rolling mills. After the parts had been assembled a second and similar coat of primer was applied. Final painting was simplified since all scale and rust had been removed and workers claimed that the steel was easier to work with. Corrosion resistance is expected to last up to two years.

Lubricants for South African Power Station

The contract to supply the turbine oil for the first stage of what will be the largest thermal power station in South Africa has been awarded to BP Southern Africa (Pty) Ltd. The new power station is being erected by the Electricity Supply Commission of South Africa near the Komati River in the Transvaal. The first stage includes five turbo generator sets which will be commissioned between September 1961 and January 1964.

The scheme calls for up to twelve 100 mw turbo generators to be installed eventually.

The new mobile drill rig

Mobile Seismic Drill Rig

In initial trials in Libya of the new Joy Mobile *Seismic-Air 400* drill rig, 20-ft deep shot-holes are being drilled in four minutes using 1½-in round steels with 2-in X-type T.C. Joy bits. The new rig is a completely mobile, self-contained unit mounted on a Cummins-engined International Model 200 truck. It can be equipped for a variety of applications and hole depths. The new rig is produced by the Air Power Division of Joy-Sullivan Ltd.

Success of Gas Turbine at Fawley

The English Electric Co. reports that its EM27 gas turbine plant, which is directly coupled to a Clark multi-stage gas compressor handling propylene at Esso's Fawley refinery, was out of commission due to minor faults for only 38 hours during its first 13,761 hours of operation. The longest non-stop run was 4111 hours, almost six months.

After it had been in operation for 9200 running hours the turbine was dismantled for examination purposes and component parts were still found to be in excellent condition, the only replacements needed being minor ones such as gaskets, rings, etc.

Nitrogen/hydrogen Mixture from Blast Furnace Gas

A process designed by its Gas Atmospheres Division for producing nitrogen/hydrogen mixture from blast furnace gas is described in a leaflet published by The Incandescent Heat Co. Ltd. The hydrogen content of the resulting mixture is said to be from 1–8 per cent. The basic plant designs cover 10,000, 25,000, 50,000, and 100,000 scfh units and the makers claim that the part-time services of one man is all that is required for continuous operation of plant.

Aircraft Hydraulic Filters

An eight-page bulletin describing *Supramesh* aircraft hydraulic filters rated at absolute 15 microns is available from Aircraft Porous Media, Inc, 30 Sea Cliff Avenue, Glen Cove, New York. It contains drawings and technical data as well as providing detailed information on flow rates with various fluids, porting, assembly weights, and pressure ratings.

Phthalic Anhydride Developments

Hugh Harper, assistant vice-president of the Scientific Design Co. Inc and managing director of SD Plants Ltd, announced in a paper presented at Manchester University, that it was now possible by the SD Process to obtain phthalic anhydride yields from ortho-xylene of the order of 85 lb–90 lb of phthalic anhydride per 100 lb of ortho-xylene.

The process was said to allow the maleic anhydride produced by the ortho-xylene oxidation to be recovered and converted inexpensively to fumaric acid.

Hydraulic Pull Broacher

Lapointe Machine Tool Co. Ltd, of Watford, Herts, collaborating with the Cameron Iron Works, has produced one of the largest horizontal hydraulic pull broachers yet made. The machine has been designed to broach the body cavities, to very close tolerances, in alloy steel gate valve forgings. By taking full advantage of the 100 in stroke, it will produce a rectangular hole $5\frac{1}{2}$ in $\times$ $2\frac{3}{4}$ in from a $2\frac{5}{16}$ in diameter starting hole in fourteen passes.

Perkins New Power Pack

A new power pack producing over 100 hp has been announced by Perkins Engines Ltd. Incorporating the direct injection six-cylinder, 5·8 litre Perkins *Six 354* industrial diesel engine, the new power pack is rated at 104 hbp at 2400 revs/min for intermittent use, and at 85 bhp at 2000 revs/min for continuous operation.

The unit is available in every stage from a basic industrial engine, and various pedestal mounted units, to a complete power pack with canopy. It has been developed to meet a wide range of power requirements for stationary and mobile plant, including drilling rigs.

Seam-Welding Blanks

In the interests of international standardization, Johnson Matthey is now making a wider range of rough-machined seam-welding wheel blanks in *Mallory* 3. They are now available in metric sizes which are very close to the superseded inch sizes. Details of the new range of sizes are given in a leaflet "Resistance Welding Electrode Materials", obtainable from the Company, at 73–83 Hatton Garden, London, E.C.1.

Consolidated Zinc Change of Address

The Consolidated Zinc Corp. Ltd has a new London address: 6 St James's Square, London, S.W.1. However its registered and transfer offices are remaining at 8 Basinghall Street, London, E.C.2.

Exactor Ltd's New Address

Exactor Ltd has moved to Sterling Works, Blacknell Lane, Crewkerne, Somerset.

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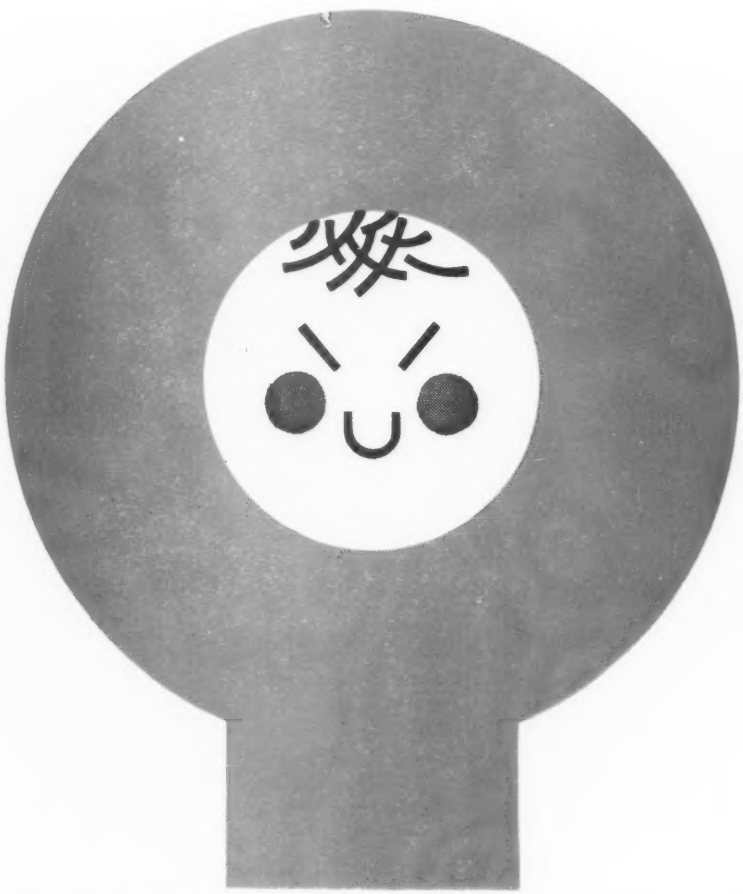

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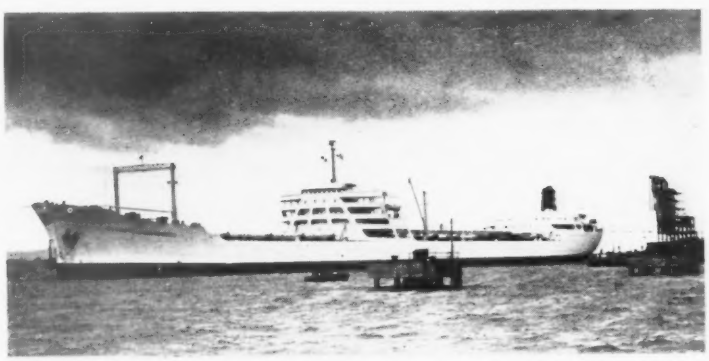

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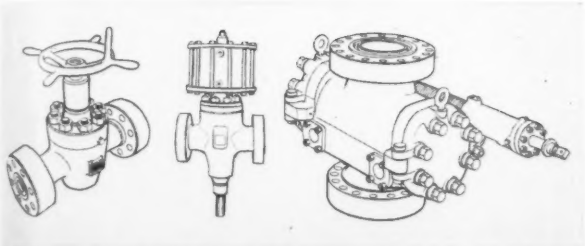

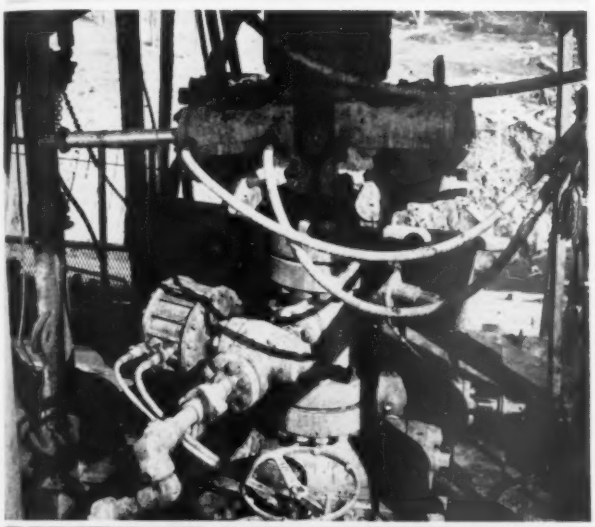

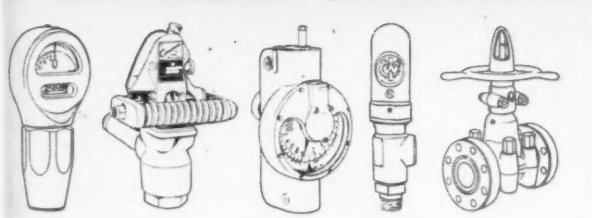

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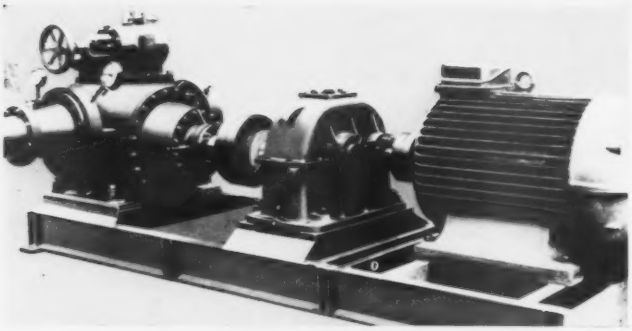

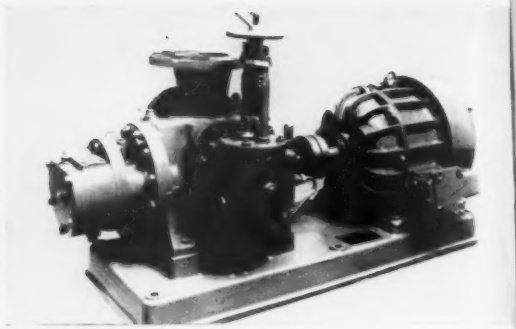

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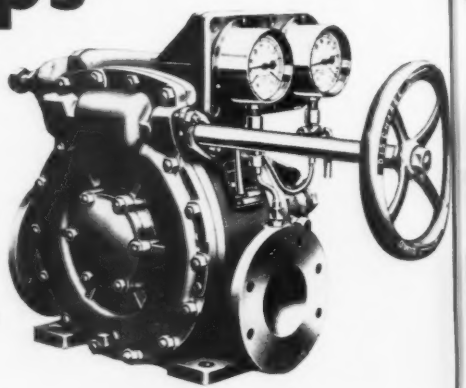

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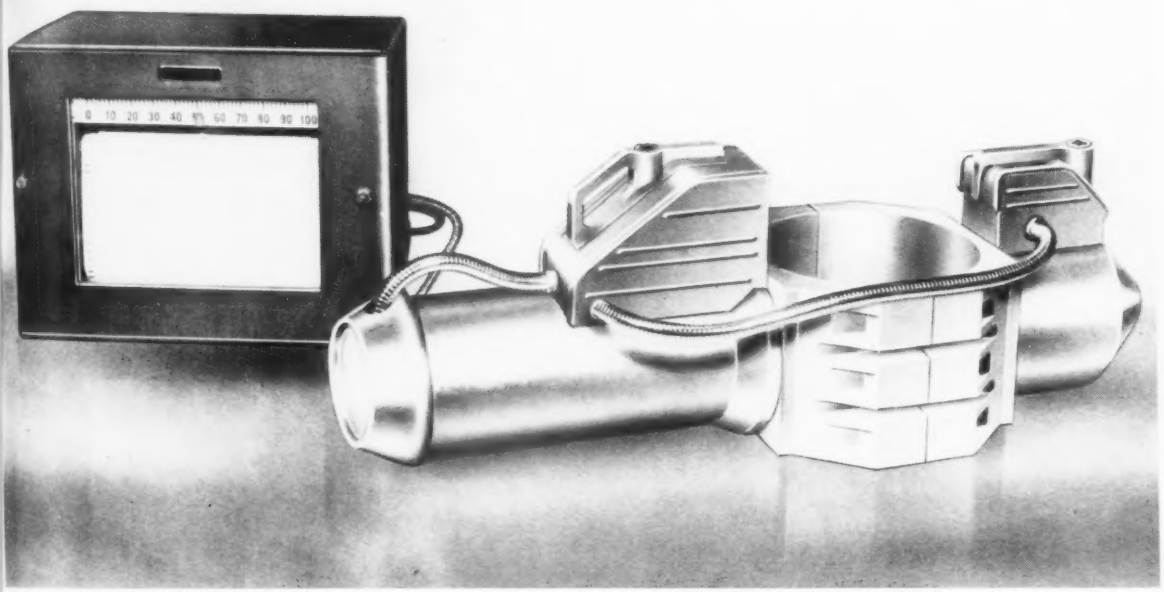

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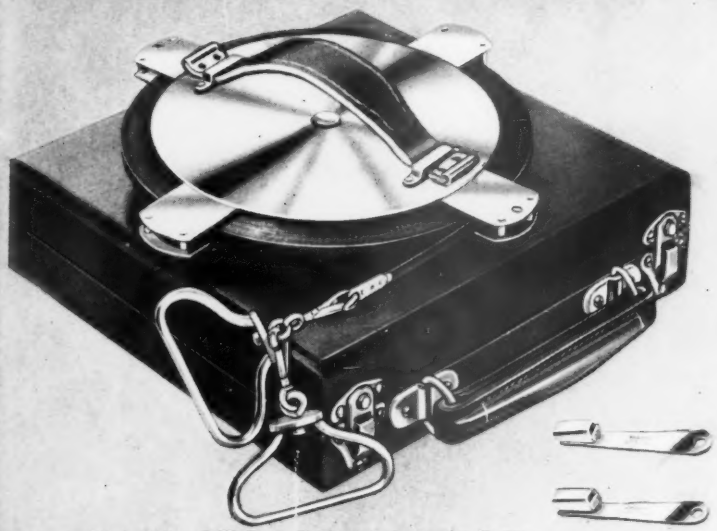

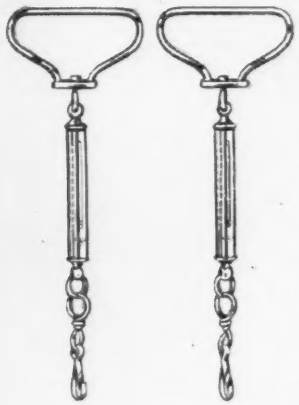

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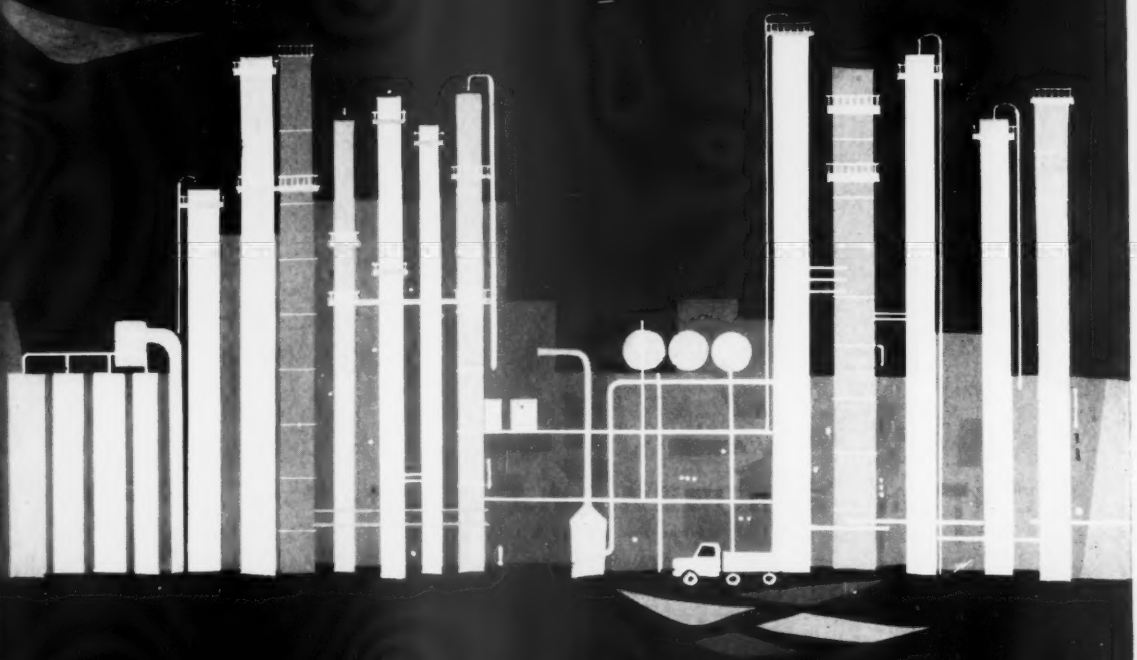

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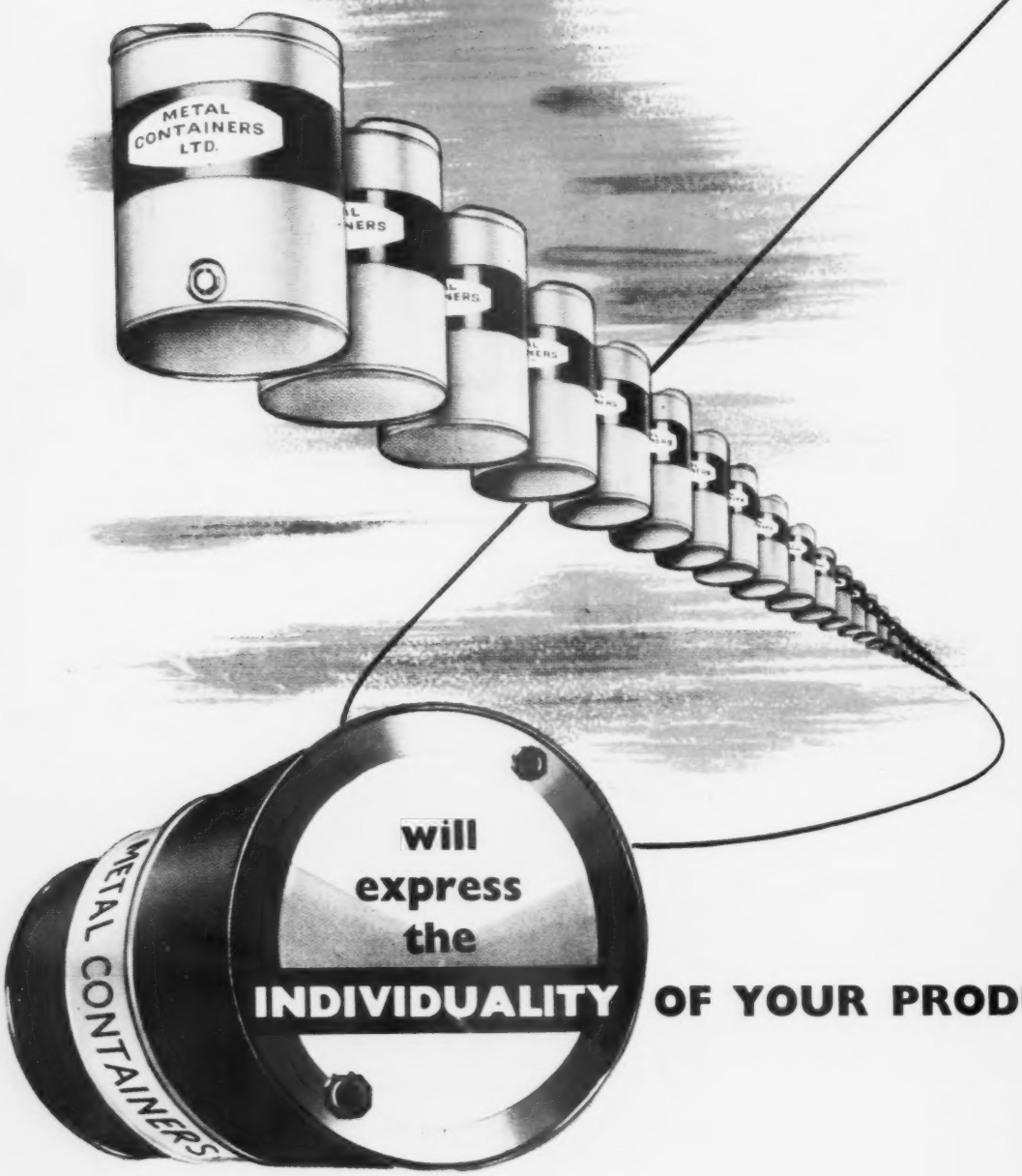

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